

**RE800**

**Theological and  
Scientific Reasoning:**

A Comparison of the Thought of  
Stanley Jaki,  
John Polkinghorne and  
Thomas Torrance

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Theology cannot just be left to the theologians, as is made clear by the recent spectacle of a distinguished theologian writing over three hundred pages on God in creation with only an occasional and cursory reference to scientific insight. It is as idle to suppose that one can satisfactorily speak about the doctrine of creation without taking into account the actual nature of the world, as it would be to think that the significance of the world could be exhaustively conveyed in the scientific description of its physical processes. There must be a degree of consonance between the assertions of science and theology if the latter are to make sense and hence there is an urgent need for dialogue between the two systems.

John Polkinghorne: *Science and Creation*, page 2.

But since both natural science and theological science operate within the same framework of space and time, which is the carrier of all our creaturely rationality, their inquiries cannot but overlap, even though they move in different directions owing to the different ends they have in view. And yet the more rigorous their questioning is, the more aware they are of the limits which they cannot rationally cross and the more ready they are to suspend judgment, and even to call for help from one another before the face of the Creator.

Thomas Torrance: *The Christian Frame of Mind*, page 27.

The theist also knows that the universe must be queerer than he can imagine, because he knows that he can never be privy to the Creator's sovereign choice in creating a world of which man is an equally contingent constituent. The supreme queerness in all this is the ability of the mind to master what is not mind by finding it to be a coherent whole, queer as it may appear beyond any expectation. By relating the queerness to the ultimate ground of all being, cosmic queerness becomes that cosmic singularity which points to the Ultimate in intelligibility and being.

Stanley Jaki: *The Road of Science and the Ways to God*, page 278.

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## Abstract

The relationship between the religious view of the cosmos and the gradually developing scientific view is a matter for continual debate. This essay examines the way this relationship has been treated by three modern writers on the topic. Particular emphasis is paid to the different approaches taken by each of them towards a common problem.

In the Introduction an overview of the subject is given. Here a useful classification of approaches to the science-religion dialogue is given.

The second chapter contains a brief survey of some of the more important writings on the subject, from the time of Augustine up to the 1960s.

The third chapter covers the writings of Stanley Jaki, Benedictine priest and Ph.D. in physics. His major theme is that modern science arose only because of the Christian concept of creation by a rational God.

The fourth chapter covers the work of John Polkinghorne, Anglican priest and fellow of the Royal Society of London. He emphasises the need to consider many levels of discourse, in both science and religion.

The fifth chapter considers a small selection of the writings of Thomas Torrance, former Moderator General of the Church of Scotland. His main theme is the rationality and contingency of the universe, which it owes to creation by a rational God.

In the sixth chapter a brief survey is given of some of the writings on the topic between 1980 and 1989. This shows some convergence in approach, but not complete unity as yet.

The final chapter draws together the main ideas which have emerged in this study. It is argued that writers in this area are gradually moving towards seeing science and religion as both being important ways of looking at the natural world. It is concluded that the best approach is one in which both religion and science are respected for the different interpretations they bring to study of the same awe-inspiring universe. It is also shown that in spite of the vast amount of writing in this area there are still a number of unanswered questions. The major one, which is considered at reasonable depth only by Polkinghorne, is how it is possible to interpret any interaction between God and the natural world.

# Chapter 1

## Introduction

Religious faith and science have no quarrel. Both are ways of trying to understand the universe and our place in it. Should either faith or science masquerade as the other the result is confusion.

D.R. Selkirk and F.J. Burrows<sup>1</sup>

Differences of opinion between those who based their lives on some religious belief and those who spent their lives investigating the complicated world around us have occurred with monotonous regularity. They have ranged from mild disagreements, through acrimonious disputes, to vehement accusations of wilfully misleading people.

One point which is rarely considered in the disputes is how the two sides each go about deriving their points of view. Some fundamental agreements, and differences, between religious and scientific ways of reasoning is the topic of this essay.

On the religious side it is restricted to a consideration of Christianity. This is mainly because, outside the three main monotheistic religions (Judaism, Christianity and Islam), there seems to have been little interest in trying to relate religious ideas to the natural world. It is true that we have, for example, the trinity of Brahma the creator, Vishnu the preserver, and Shiva the destroyer in Hinduism. However none of these are taken to be involved with the natural world in the same sense as God is in traditional Christianity, for example.

The discussion is further restricted to the natural sciences. These have a much longer history, and much firmer foundations, than the social sciences. There is thus a much stronger basis for drawing conclusions about interactions between scientific and religious ways of reasoning. This is despite the fact that it is almost impossible to give a definition of science, as Polanyi has pointed out<sup>2</sup>:

In Lecture II on 'Authority and Conscience' it will be explained that the premisses of science cannot be explicitly formulated, and can be found authentically manifested only in the practice of science, as maintained by the tradition of science. This should not be understood to deny the usefulness of analysing the premisses of science.

as well as various other writers.

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<sup>1</sup>D.R. Selkirk and F.J. Burrows, (eds.): *Confronting Creationism: Defending Darwin*. The New South Wales University Press, Kensington, NSW, 1987. Page xi.

<sup>2</sup>Michael Polanyi: *Science, Faith and Society*. The University of Chicago Press, Chicago, 1964. Page 85. (Originally published in 1946.)

Recently the types of interactions between religion and science have been classified by Proudfoot<sup>3</sup> into six categories. These are not completely independent, and there are significant overlaps between some of his categories. It is, however, worth quoting Proudfoot here for future reference. His categories are<sup>4</sup>:

1. Science can be subordinated to religious belief. We often relegate this standpoint to the realm of traditional and now antiquated controversy over the heliocentric universe or Darwinian evolution; yet the dispute over “creation science” and the resurgence of theological fundamentalism are recent phenomena.
2. Religious belief can be revised in the light of modern science and a conception of God can be formulated employing resources from the current state of our knowledge about the universe.
3. The scientific method can be applied to religious experience, belief, and practice, as was advocated by William James.
4. Religious thought and practice can be distinguished from science by reason of their concern with questions of meaning, value, and human purpose, each of which is beyond the reach of scientific description and explanation.
5. Religious language, concepts, and belief are completely different from and independent of the language and practice of science. One can argue on theological grounds, or by analysis of the tacit grammar that governs the use of concepts and evidence in the two spheres, that they have different aims and rules and do not impinge upon one another at all.
6. A stress on the autonomy of religious belief can be combined with attention to certain parallels between religious and scientific inquiry.

As mentioned in this quotation, the modern creationist movement is an example of category 1<sup>5</sup>. Very few theologians, even within the conservative stream, adopt this position. Under 2 could be put much of the writing of “liberal” theologians in the early part of this century, the process theology of Whitehead and his school, and much of Bultmann’s “demythologizing” programme. William James, as mentioned, typifies category 3. The writings of Paul Tillich, and anthropologists such as Clifford Geertz, would (mostly) come in category 4. The outstanding example of category 5, from the religious side, is undoubtedly Karl Barth. From the scientific side this is paralleled by the 1972 statement of the National Academy of Sciences in USA<sup>6</sup> that “. . . science and religion are, therefore, separate and mutually exclusive realms of human thought . . .”

The recent work of Montefiore<sup>7</sup> clearly falls mostly within category 6. So also do most of the writings of the three people whose work is treated in some detail in this essay.

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<sup>3</sup>Wayne Proudfoot: “Religion and Science”, pp. 268–279 in *Altered Landscapes — Christianity in America, 1935–1985*, ed. David W. Lotz, Donald W. Shriver, Jr. and John F. Wilson. William B. Eerdmans Publishing Company, Grand Rapids, Michigan, 1989.

<sup>4</sup>*ibid.*, pp. 270f.

<sup>5</sup>See, for example, any of the writings of Henry M. Morris.

<sup>6</sup>Quoted in William H. Austin: *The Relevance of Natural Science to Theology*. Macmillan, London, 1976.

Page 1.

<sup>7</sup>Hugh Montefiore: *The Probability of God*. SCM Press, London, 1985.

The idea that there has been continual “warfare” between conservative religious forces and enlightened scientific thinkers is still widespread. This arose in the latter part of the 19th century, as part of a more general reaction against religion, and is typified by the work of White<sup>8</sup>, who was not opposed to religion himself. The present Archbishop of York, John Habgood, realised that the “warfare” idea did not give a complete picture, and preferred to use the term “uneasy truce”<sup>9</sup>. More recently Moore<sup>10</sup> has shown, at least for the Victorian period, that the “warfare” metaphor is, at best, misleading, and for some sections of Christian belief is quite wrong. Nevertheless the idea of conflict remains in the popular mind.

The great success achieved by science in explaining so many facets of the world around us had led many people, scientists, theologians and laity alike, to assume, either explicitly or (more usually) implicitly, that it is capable of explaining everything. This trend has been particularly evident over the last century, and it makes science into a religion. This general feeling in the community is in line with Proudfoot’s category 2. This has been especially noticeable in the biological realm, as is shown from the titles (and content) of the books by Thomson<sup>11</sup> and Midgley<sup>12</sup>. Writers in the physical sciences have not shown the same trend. On the contrary, they have tended to use scientific findings as a bolster to traditional religious ideas about “design” in the universe<sup>13</sup>. This belief is in line with Proudfoot’s categories 3 and 6.

The three writers whose work will be discussed here are all in holy orders, and are distributed fairly widely across the spectrum of Christian belief. Stanley Jaki is a Benedictine priest, and has a fairly strong commitment to traditional Catholic theology and ways of reasoning. John Polkinghorne is a Professor of Mathematical Physics turned Anglican priest, and may be described as fairly middle-of-the-road, with leanings towards the conservative side. Thomas Torrance is a former Moderator of the Church of Scotland, and strongly on the conservative-evangelical side theologically.

Their formal qualifications for writing about science and religion are quite different. Torrance was born in 1913 and ordained in 1940. He was awarded a D.Th. from the University of Basel in 1946. He was elected Moderator of the Church of Scotland for 1976–1977. He has no formal scientific qualifications. Jaki was born in 1924 in Hungary, and ordained in 1948. He was awarded a Dr.Syst.Th. in 1950, and a Ph.D. in physics in 1957. Polkinghorne was born in 1930 and ordained in 1981. He was awarded a Ph.D. in 1955 and a Sc.D. in 1974. He was elected as a Fellow of the Royal Society of London also in 1974.

These writers do not, of course, cover the full range of Christian beliefs. There are the Orthodox churches on one side, and the fundamentalists on the other. Even within the range from Catholic to conservative Protestant we would need to include a writer from the liberal Protestant and/or process theology stream to have a reasonably complete coverage.

Writers from the Orthodox stream have taken relatively little interest in the interaction

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<sup>8</sup>Andrew Dickson White: *A History of the Warfare of Science with Theology in Christendom*. Peter Smith, Gloucester, Massachusetts, 1978. Originally published in 1896.

<sup>9</sup>John Stapylton Habgood: *The Uneasy Truce between Science and Theology*. Pp. 21–41 in A.R. Vidler (ed.), *Soundings — Essays Concerning Christian Understanding*. Cambridge University Press, Cambridge, 1962.

<sup>10</sup>James R. Moore: *The Post-Darwinian Controversies — A study of the Protestant struggle to come to terms with Darwin in Great Britain and America, 1870–1900*. Cambridge University Press, Cambridge, 1979.

<sup>11</sup>J. Arthur Thomson: *The Gospel of Evolution*. George Newnes Limited, London, 1925.

<sup>12</sup>Mary Midgley: *Evolution as a Religion — Strange Hopes and Stranger Fears*. Methuen, London, 1985.

<sup>13</sup>For example; Paul Davies: *God and the New Physics*. Penguin Books, Harmondsworth, Middlesex, 1984; or the “Epilogue” in James S. Trefil: *The Moment of Creation — Big Bang Physics from before the First Millisecond to the Present Universe*. Macmillan, New York, 1983.

between science and theology. As an example, the chapter in Ware's book<sup>14</sup> dealing with creation contains almost nothing about scientific ideas, either ancient or modern. It is restricted to a discussion of theological concepts.

The other extreme is typified by the modern fundamentalist, and in particular by the creationist movement. A (sometimes) literal interpretation of the Bible is taken as the "correct" starting point for science. Any discrepancy between the creationist interpretation of the Bible and scientific findings is attributed to errors made by scientists whose minds have been blinded by humanism.

The liberal Protestant stream is fairly well represented by many of the articles in *Zygon*. Most of these, however, do not attempt to devise a methodology for dealing with the differences between scientific and theological ways of reasoning, but are more interested in modifying theological understandings to take account of scientific findings.

The next chapter of this essay gives a brief historical survey of some of the more influential writings about the interaction between science and religion.

This is followed by three chapters dealing, in order, with the views of Stanley Jaki, John Polkinghorne, and Thomas Torrance. It is not possible to cover all their ideas, particularly those of Torrance, in the space available. However most of the main issues are treated.

A brief chapter follows touching on some other writings on the same topic which have appeared over the last ten years. Each of Proudfoot's categories 2 to 6 have adherents among recent writers.

The concluding chapter draws together the main ideas which have emerged in this study. It is shown that writers in this area are gradually moving towards seeing science and religion as both being important ways of looking at the natural world, with neither being supreme over the other. It is also shown that in spite of the vast amount of writing in this area there are still a number of unanswered questions. The major one, which is considered at reasonable depth only by Polkinghorne, is how it is possible to interpret any interaction between God and the natural world.

It is suggested that, despite its venerable age, Ian Barbour's book *Issues in Science and Religion* is still the most useful. In the absence of any comparable more modern work, this essay includes some fairly extensive quotations from the writings of Jaki, Polkinghorne and Torrance. These illustrate some of the ideas they hold in common, and also their differences.

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<sup>14</sup>Archimandrite Kallistos Ware: *The Orthodox Way*. Mowbray, London, 1979. Chapter 3, "God and Creation".

# Chapter 2

## A Brief Historical Survey

We should wait: but we should not wait passively, or in despair. The clash is a sign that there are wider truths and finer perspectives within which a reconciliation of a deeper religion and a more subtle science will be found.

A.N. Whitehead<sup>1</sup>

The literature on the interactions between science and theology is vast in extent. Bibliographic tools are, as yet, in a very incomplete state. This survey covers the period up to the 1960s, the date of the earliest major works by Torrance on the subject, and also the date of the beginning of the modern creationist upsurge in USA.

The bibliography in Moore<sup>2</sup> is restricted to the period 1870–1900. Despite this it extends to 58 pages. The bibliography by Eisen and Lightman<sup>3</sup> is restricted to secondary literature on the Victorian period, but it has over 6000 entries. Mclver<sup>4</sup> restricted his work to specifically anti-evolution works, and also excluded periodical literature. Even so, he lists over 1800 items.

Until the 19th century it seems to have been widely accepted, both by those who supported Christianity and by its detractors, that the authors of the Bible intended their words to be read as actual descriptions of events. The first recorded reference to the idea that theological concepts could be obtained from consideration of the natural world can be found in the letter written by Paul to the Christians at Rome. Early in this he wrote<sup>5</sup>:

For what can be known about God is plain to them, because God has shown it to them. Ever since the creation of the world his invisible nature, namely, his eternal power and deity, has been clearly perceived in the things that have been made.

These words led to the vast number of writings on natural theology. The prolific writer Augustine mentioned the natural world in many of his works. To give just three examples, in book XI of his *Confessions*<sup>6</sup> he considers the meaning of the phrase “In the beginning”,

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<sup>1</sup>A.N. Whitehead: *Science and the Modern World*. Cambridge University Press, Cambridge, 1926. Page 229.

<sup>2</sup>James R. Moore, op. cit.

<sup>3</sup>Sydney Eisen and Bernard V. Lightman: *Victorian Science and Religion — A Bibliography with Emphasis on Evolution, Belief, and Unbelief, Comprised of Works Published from c. 1900–1975*. Archon Books, Hamden, Connecticut, 1984.

<sup>4</sup>Tom Mclver: *Anti-Evolution — An Annotated Bibliography*. McFarland & Company, Jefferson, North Carolina, 1988.

<sup>5</sup>Romans 1:19,20, Revised Standard Version.

<sup>6</sup>St. Augustine: *Confessions*. Translated with an Introduction by R.S. Pine-Coffin. Penguin Books, Harmondsworth, Middlesex, 1961.

and then moves on to a discussion of the nature of time. Books XI and XII of *The City of God*<sup>7</sup> discuss the early parts of Genesis, and argue against the idea of cosmic cycles. In the early parts of his large commentary on Genesis, only available in English fairly recently<sup>8</sup>, Augustine urged caution on his readers when trying to relate knowledge about the natural world to theological ideas. The long section 39 in chapter 19 of Book 1 was quoted, in part, by Galileo, and is reproduced in full in the Appendix. The final sentences are worth repeating here, to show that even then there were people advancing peculiar ideas in the name of Christianity. After criticising Christians who talk nonsense Augustine wrote<sup>9</sup>:

Reckless and incompetent expounders of Holy Scripture bring untold trouble and sorrow on their wiser brethren when they are caught in one of their mischievous false opinions and are taken to task by those who are not bound by the authority of our sacred books. For then, to defend their utterly foolish and obviously untrue statements, they will try to call upon Holy Scripture for proof and even recite from memory many passages which they think support their position, although *they understand neither what they say nor the things about which they make assertions.*

The last 14 words here are quoted from Paul's First Letter to Timothy, chapter 1, verse 7.

During the medieval period much time and effort was expended in determining a meaning of the text which was compatible with the current views about the natural world. This reached its zenith (or perhaps nadir) with the geocentric ideas of Hell in the centre of the earth, and a number of concentric heavens, each with its own order of angels. An excellent popular account of this is contained in Dante's *Divine Comedy*.

In Reformation times astronomy was the only area of study which could be classified as a "science". Medieval cosmology, which owed far more to Greek ideas than to the Bible, came into conflict with scientific study, and the well-known Galileo affair is just one aspect of this conflict. However not all theologians opposed scientific advances. The reformed theologian John Calvin was one who accepted that science and theology could both contribute to our understanding of the universe, as is shown by his words "He who would learn astronomy, and other recondite arts, let him go elsewhere."<sup>10</sup>

The 17th century saw the founding of the great scientific societies, and the publication of works such as Isaac Newton's *Principia Mathematica*. This period has been discussed, for England, by Westfall<sup>11</sup>, who showed that most of those involved felt that there was a large degree of consonance between their scientific work and their religious beliefs. They did not anticipate the way their work would be misinterpreted by the 18th century deists.

With the rise of geological study at the end of the 18th and the early part of the 19th centuries, cracks started to appear in the unified front which scientists and theologians presented. Although many of the early geologists were ordained clergymen<sup>12</sup>, they were too honest to cling to the traditional age of the earth when evidence started to mount that it was

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<sup>7</sup>St. Augustine: *Concerning The City of God against the Pagans*. A new translation by Henry Bettenson with an introduction by David Knowles. Penguin Books, Harmondsworth, Middlesex, 1972.

<sup>8</sup>St. Augustine: *The Literal Meaning of Genesis*. Translated and annotated by John Hammond Taylor, S.J. Newman Press, New York, 1982. 2 volumes.

<sup>9</sup>*ibid.*, volume 1, pages 42f.

<sup>10</sup>John Calvin: *Genesis*. Edinburgh, The Banner of Truth Trust, 1965. Page 79.

<sup>11</sup>Richard S. Westfall: *Science and Religion in Seventeenth-Century England*. The University of Michigan Press, Ann Arbor, Michigan, 1972.

<sup>12</sup>For example, Adam Sedgwick (1785–1873). His work in North Wales led to the identification and naming of the Cambrian system, the earliest rocks containing large numbers of fossils (580–520 million years old). Together with Sir Roderick Murchison he classified the Devonian system.

millions, rather than thousands, of years old. Some of the conflicts which arose have been discussed by Gillispie<sup>13</sup>, and more recently by Albritton<sup>14</sup>.

Following the publication of Charles Darwin's *Origin of Species* in 1859, there was a flurry of writing on science and religion. Some of the works opposed Darwin, some supported him. Later that century there was an interest in the wider issue of the relationship between science and religion.

To give some indication of the extent of writing on the topic, for the years 1950–1959, excluding any works by professional scientists, and published versions of the Gifford Lectures, we have, amongst others, the works by Richardson<sup>15</sup>, Heim<sup>16</sup>, Raven<sup>17</sup>, Mascall<sup>18</sup>, Gilkey<sup>19</sup>, and Hooykaas<sup>20</sup>. These span a very wide range of theological viewpoints, and take a range of attitudes towards scientific ideas.

Following 1959, the centenary year of the publication of Darwin's *Origin of Species*, there was somewhat of an upsurge in writing about the interaction between science and religion. Only a small selection of works published in this period will be mentioned here.

Undoubtedly the most significant book in the area published in the 1960s was Barbour's *Issues in Science and Religion*<sup>21</sup>. This is still an important source book. He subsequently edited a volume<sup>22</sup> in which the articles were intended, as stated in the preface, "... to encourage discussion, not to present a systematic set of answers."

Several scientists produced books giving their personal views on how they related their scientific work to their religious views. From the side of the physical sciences Huntley<sup>23</sup> wrote about the order he perceived in the universe. The preface to the book included the sentence:

A principal theme of the following pages is that the Creator, in giving being to his creatures, animate and inanimate, displays a definite form, an individual style, which characterizes all his works; and that the scientist, through preoccupation with the intensive studies of those works, cannot avoid the indoctrinating influence of the style any more than can the cloistered monk remain unaffected by the Object of his worship.

Charles Birch wrote from the viewpoint of a biologist. His work<sup>24</sup> followed the ideas of process theology fairly closely.

John Habgood gained a Ph.D. in physiology from the University of Cambridge before entering the Anglican ministry. His book<sup>25</sup> is largely irenic in tone, as befits someone who

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<sup>13</sup>Charles Coulston Gillispie: *Genesis and Geology — A Study of the Relations of Scientific Thought, Natural Theology and Social Opinion in Great Britain, 1790–1850*. Harvard University Press, Cambridge, Massachusetts, 1951.

<sup>14</sup>Claude C. Albritton, Jr.: *The Abyss of Time — Changing Conceptions of the Earth's Antiquity after the Sixteenth Century*. Freeman, Cooper & Company, San Francisco, 1980.

<sup>15</sup>Alan Richardson: *Science, History and Faith*. Oxford University Press, London, 1950.

<sup>16</sup>Karl Heim: *Christian Faith and Natural Science*. SCM Press, London, 1953.

<sup>17</sup>Charles E. Raven: *Christianity and Science*. Lutterworth Press, London, 1955.

<sup>18</sup>E.L. Mascall: *Christian Theology and Natural Science — Some Questions on their Relations*. Longmans, London, 1956.

<sup>19</sup>Langdon Gilkey: *Maker of Heaven and Earth — The Christian Doctrine of Creation in the Light of Modern Knowledge*. Doubleday, Garden City, New York, 1959.

<sup>20</sup>R. Hooykaas: *Natural Law and Divine Miracle — A Historical-Critical study of the Principle of Uniformity in Geology, Biology and Theology*. E.J. Brill, Leiden, 1959.

<sup>21</sup>Ian G. Barbour: *Issues in Science and Religion*. SCM Press, London, 1966.

<sup>22</sup>Ian G. Barbour (ed.): *Science and Religion — New Perspectives on the Dialogue*. SCM Press, London, 1968.

<sup>23</sup>H.E. Huntley: *The Faith of a Physicist*. Geoffrey Bles, London, 1960.

<sup>24</sup>L. Charles Birch: *Nature and God*. SCM Press, London, 1965.

<sup>25</sup>John Habgood: *Religion and Science*. Hodder and Stoughton, London, 1972 (originally published 1964).

was destined to become Archbishop of York. He expresses his theme in the following words (on page 10):

It is the assertion that we must learn to live with a certain amount of conflict and untidiness, which is the essence of the fourth view. I believe that there are no final answers to many of the traditional problems of science and religion, and that we oversimplify our actual experience of life if we ignore one or the other of them. or imagine that the conflict between them is of the kind which one side or the other must win.

It is unlikely that he foresaw the creationist conflict, the seeds of which had already started to sprout.

In a small book Farrer<sup>26</sup> gave a careful discussion of the nature of “explanations” in science and religion. He pointed out the (generally ignored) fact that scientists are selective in the data they interpret (a good example of Polanyi’s “personal knowledge”), and drew parallels between religious experiences as evidence for God, and scientific investigations as evidence for the behaviour of the natural world.

Happold<sup>27</sup>, in a rather unusual work, suggested that an approach via mysticism may be useful in relating religious experiences to the scientific world view.

Very few of the books mentioned above deal in any significant way with methodological issues. Barbour’s book *Issues in Science and Religion*, with its sections on “Religion and the Methods of Science” and “Religion and the Theories of Science”, is a notable exception, and this accounts for its enduring worth. The works by Mascall and Hooykaas make smaller contributions to the topic. Most of the others only mention it in passing, if at all.

The number of works published in the area increased rapidly after 1969, with the rise of the modern creationist movement. Some of the more recent writings are referred to in a later chapter in this essay.

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<sup>26</sup>Austin Farrer: *A Science of God ?* Geoffrey Bles, London, 1966.

<sup>27</sup>F.C. Happold: *Religious Faith and Twentieth Century Man*. Penguin Books, Harmondsworth, Middlesex, 1966.

# Chapter 3

## Stanley Jaki

It should be of much food for thought that science, which is a most purposeful endeavour aimed at the understanding and control of the physical, has been unable to foster a vivid appreciation in man for an understanding of purpose, let alone of that purpose of his which is spiritual.

Stanley L. Jaki<sup>1</sup>

Stanislas Ladislav Jaki was born in 1924 in Győr, Hungary<sup>2</sup> (his first name is almost always anglicised to Stanley). He was ordained a priest in the Roman Catholic church in 1948. He gained a Doctorate in Systematic Theology from the Pontifical Institute of St. Anselm, Rome, in 1950. In 1957 he gained a Ph.D. in physics from Fordham University, New York. He delivered the Gifford Lectures at the University of Edinburgh in 1974–75 and 1975–76. He was awarded the Templeton Prize for religious writing in 1987. At present he is Distinguished Visiting Professor at Seton Hall University, New Jersey.

Jaki is primarily a historian, and this shows in his writings. His two largest works on the interaction between science and religion are *Science and Creation*<sup>3</sup> and *The Road of Science and the Ways to God*.<sup>4</sup> In both of these the major theme of his writing appears. This is that the rise of modern science can be traced to the belief held in reformation Europe about the creation of the universe by one God. It is probably going too far to describe him as a monomaniac about the idea, but his excessive emphasis on this theme detracts, to some extent, from the value of his writings.

In one of his early papers<sup>5</sup> he considers the extent to which some sort of faith plays a role in the development of physics. Early in the paper he writes<sup>6</sup>: "...historic breakthroughs in physics are as much the product of a trusting faith in nature as of a critical analysis of the facts of nature". He also mentions one of the main problems associated with faith<sup>7</sup>: "Faith can, of course, be blind, but so can unbelief,..." The faith he is writing about in this paper is related to, but is different from, faith as it is usually understood in theology. Throughout the paper he regularly refers to science whereas, as the title shows, he is really restricting his

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<sup>1</sup>Stanley L. Jaki: *The Origin of Science and the Science of its Origin*. Scottish Academic Press, Edinburgh, 1978. Page 103.

<sup>2</sup>Biographical information taken from *Who's Who in America*, 45th ed., 1988–1989, vol. 1, p. 1551.

<sup>3</sup>Stanley L. Jaki: *Science and Creation: From Eternal Cycles to an Oscillating Universe*. Scottish Academic Press, Edinburgh, 1974. Referred to subsequently as *Science and Creation*.

<sup>4</sup>Stanley L. Jaki: *The Road of Science and the Ways to God*. University of Chicago Press, Chicago, 1978. The Gifford Lectures at Edinburgh, 1974–1976. Referred to subsequently as *The Road of Science*.

<sup>5</sup>Stanley L. Jaki: The Role of Faith in Physics. *Zygon*, vol. 2 (1967), pp. 187–202.

<sup>6</sup>ibid., page 187.

<sup>7</sup>ibid., page 188.

comments to physics. In theology faith is usually taken to mean belief which is adopted in the absence of concrete evidence, such as faith in the existence of God. The kind of faith about which Jaki is writing is continually reinforced, in a way faith in the theological area rarely is. With particular reference to those physicists who are working at the forefront of knowledge, he expresses it this way<sup>8</sup>: “For them, the possibility of science implies a constant renewal of their faith in the orderliness of nature”.

He puts it in somewhat more detail when he moves on to discuss some of the problems which have arisen in the field of the physics of elementary particles<sup>9</sup>:

No physicist can tell us today what are the true parts of the ultimate system of particles; yet, all believe firmly in the existence of such a system. This faith of theirs is not an easy one. After all, they are witnesses to the fact that assuredly stable particles turn out to be subject to decay.

This statement shows one of the dangers of taking the beliefs of scientists at one point of time in the ever-changing scientific enterprise and using it as a basis for some theological discussion. There have been an enormous number of advances in elementary particle physics since 1967. Over the last century the concept of the ultimate unit of matter has changed from atoms (in the late 19th century) to protons, neutrons and electrons (in the 1930s) to quarks and leptons (today). It would be a rather brave (or rash) physicist who would even dare to say that there *is* some ultimate system of particles, rather than some ever-descending sequence of more and more elementary entities. It is doubtful whether any would claim that quarks and leptons are the ultimate particles.

In the last half of the paper he takes up the theme which was to engage almost all his attention in subsequent writing — the origin of modern science in a Europe which was dominated by a culture which was largely Christian in outlook. He starts this section by writing<sup>10</sup>:

It is a fact of scientific history that the birth of modern science took place in a cultural ambiance [sic] wholly permeated by belief in dogmas. Foremost of these was the Christian tenet about a personal, rational Creator of the universe.

There would be few who would quarrel with the first sentence here. However there is much more room for debate about the second sentence. Although the first sentence of the various creeds mentions God as “maker of heaven and earth”, it is far from certain that most people in Renaissance and Reformation times, even those engaged in study of the natural world, believed that the world was rational, in the sense of following predetermined laws. Not only was there widespread belief in miracles, but this was fostered and encouraged by some sections of the church.

Any discussion about the historical development of ideas about “the universe” is plagued by the way this concept has changed. The work of Copernicus at the start of the modern period made virtually no change in the way theologians viewed the cosmos — it was still quite small, with the stars attached to a sphere outside the spheres of the planets (with God’s abode outside this). It was not until much later, after the rise of rationalism and deism, that the immense extent of the universe became apparent. At this time the use of the adjective “personal” in connection with the creator almost vanished. Further discussion about this point is clearly needed.

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<sup>8</sup>ibid., page 191.

<sup>9</sup>ibid., page 192.

<sup>10</sup>ibid., page 194.

The first book dealing at some length with his ideas about the rise of modern science is *Science and Creation*. It is therefore worth taking a somewhat extended look at this, to see how he attempts to justify his claim.

The thesis of the book is laid down quite clearly in the introduction<sup>11</sup>:

Great cultures, where the scientific enterprise came to a standstill, invariably failed to formulate the notion of physical law, or the law of nature. Theirs was a theology with no belief in a personal, rational, absolutely transcendent Lawgiver, or Creator. Their cosmology reflected a pantheistic and animistic view of nature caught in the treadmill of perennial, inexorable returns. The scientific quest found fertile soil only when this faith in a personal, rational Creator had truly permeated a whole culture, beginning with the centuries of the High Middle Ages.

Nowhere in the book does he give any reason for the inclusion of the adjective “personal” here. Deism is passed over in silence, perhaps because it had little influence in Continental Europe where Jaki received his initial training.

The first six chapters in the book deal, respectively, with the approach to the natural world taken in India (early Hinduism), China (Taoism), central America (the Maya and Inca cultures), Egypt, Sumer and Babylonia, and ancient Greece. He mentions the various aspects of empirical knowledge obtained by these cultures, especially as it relates to astronomy. He discusses the cyclic nature of the ideas which are to be found in them, but only to emphasise the “eternal cycles” part of the subtitle of the book.

In chapter 7 he moves on to the early Hebrews. It is here that his bias starts to emerge. He mentions that the early Hebrews shared many of the ideas of their neighbours, such as a flat earth and a great subterranean ocean. But he then goes on to write about the creation account in Genesis 2 in the following words<sup>12</sup>:

The account is, however, replete with a highly elevated mentality which constitutes the very climate of scientific thinking. Primitive as some details may appear in Genesis 2, it is animated by an uncompromising consistency of explanation which is the hallmark of scientific reasoning. In Genesis 2 there is only one effective cause, the power of God, through which heaven and earth and everything on earth has been formed.

His argument that it is a “hallmark of scientific reasoning” to write about the creation of the universe by a *single* supernatural being, as recorded in Genesis, rather than by *several* such, as in the *Enuma Elish*, seems rather forced, to say the least. And he subsequently overlooks any evidence that the Hebrews also, to some extent, accepted the idea of cycles going on almost indefinitely. Thus he writes<sup>13</sup> concerning the author of Genesis 1:

He rushes through with the business of the fourth, fifth, and sixth days, the embellishment of the heavenly vault with celestial bodies, . . .

quite overlooking the fact that the sun and moon were created to be “. . . for signs and for seasons and for days and years” (Gen. 1:14). He ignores the declaration of God after the flood (Gen. 8:22):

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<sup>11</sup>*Science and Creation*, page viii.

<sup>12</sup>*ibid.*, page 140.

<sup>13</sup>*ibid.*, page 147

While the earth remains  
    seedtime and harvest,  
    cold and heat,  
    summer and winter,  
    day and night,  
shall not cease.

Then there is the whole of the book of Ecclesiastes, and in particular the first chapter. All in all, Jaki seems to have given an inadequate interpretation of Hebrew beliefs, at least as they are found in the Old Testament.

In chapter 8 he turns to early Christianity. Here he makes frequent references to Augustine (as may be expected), and deals at some length with Augustine's insistence that time was created by God. He also speaks about the Christian idea of the finiteness of the universe in space as well as time.

Passing over chapter 9 for the time being, in chapter 10 he moves on to the Renaissance period. Subsequent chapters take up various aspects of the rise, and the varied fortunes, of the scientific enterprise. These take the story up to the early years of this century.

Chapter 14 is entitled "Oscillating Worlds and Wavering Minds". This refers to the other part of the subtitle of the book. In the initial part of the chapter he discusses the various models of the universe which have been derived from Einstein's equations of general relativity. He expressed unhappiness with Einstein's original solution, which had a finite spatial extent but was unbounded in time, with neither beginning nor end. He was equally unhappy with de Sitter's solution, which had a start in time, but no end, and was infinite in spatial extent.

As may be expected from the subtitle of the book, in this chapter he expresses a strong preference for oscillating universe. His reasons for this, with virtually no reference to scientific data, are not immediately obvious from his words. However from some vague hints it seems that he has two reasons for his preference, both theological. The universe can oscillate in size only if it is of finite spatial extent. This harks back to the finite universe of earlier times, which was, of course, much smaller than the one Jaki envisages. Why a finite, rather than an infinite (spatially), universe should be more compatible with Christian theology is not explained. His other reason is more apparent. He makes several references to eschatological ideas. Since the choice seems to lie between a universe which expands indefinitely and one which eventually collapses, if eschatological concepts are taken to apply to the universe as a whole, rather than to just this planet, it is possible to understand his preference. However this is pressing Christian ideas on eschatology well beyond reasonable limits. He is also faced with the distinct possibility that scientific evidence will turn out to contradict his basic assumptions, and there follows the demise of yet another God-of-the-gaps.

In more modern times the "steady-state" universe was proposed by Hermann Bondi and Thomas Gold, and popularised by Fred Hoyle<sup>14</sup>. Towards the end of the chapter Jaki spends some time criticising "continuous creation". He writes<sup>15</sup>:

... the process of creation postulated by the Steady-State theorists was diametrically opposed to the Christian idea of Creation. According to the latter, Creation is the work of an absolute, transcendent Being. According to the former, it is emergence out of nothing but without a Creator.

The first noteworthy thing about this is the omission of the adjective "personal", which he had emphasised earlier. The other, and more serious one, is the great confusion he shows

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<sup>14</sup>Fred Hoyle: *The Nature of the Universe*. Basil Blackwell, Oxford, 1952.

<sup>15</sup>*Science and Creation*, page 347.

about the distinction between a scientific description and the various causes (efficient, final, etc.) which have been discussed in theological writings. One suspects that his objections have more to do with the infinite age of the universe (but not individual parts of it) in the steady-state theory than the omission of any explicit reference to God. What would he make of the words of Hawking and Ellis<sup>16</sup>, that one of the predictions of general relativity is "...that there is a singularity in our past which constitutes, in some sense, a beginning to the universe" ? Sir John Eccles, giving the Gifford lectures at the same institution two years after Jaki, saw the difference between the "big-bang" and "steady-state" cosmologies in a different light, and wrote about the steady-state theorists<sup>17</sup>:

In terms of Natural Theology it would appear that, in their efforts to escape from a supernatural creation in the Big Bang by a Transcendent God, they had unwittingly proposed continual creation by an Immanent God!

It is uncertain why Jaki spends so much effort criticising the "steady-state" theories of cosmology. These had been generally abandoned many years earlier with the accumulation of experimental evidence, and in particular the cosmic microwave background radiation, which was compatible with the "big-bang", but not with continuous creation. Further he seems to be trying to say that a scientific description of the universe should be compatible with a particular theological interpretation of Genesis. This is the error creationists make.

Now to return to chapter 9, which we left on one side earlier. This is entitled "Delay in Detour", and considers the way knowledge of Greek ideas trickled through to Renaissance Europe. The first sentence in the chapter is<sup>18</sup>:

Among the roundabout developments of intellectual history few can match in suspense the haphazard detours through which the Greek scientific corpus found its way to the new world of Europe.

Jaki does not seem to realise that in writing these words he has, in one fell swoop, cast very grave doubts on almost the whole of his thesis. If it was the Christian belief in "a personal, rational Creator of the universe" which was responsible for the rise and development of modern science, why did it have to wait for the arrival of the pagan "Greek scientific corpus" before progress could ensue? Maybe the beliefs of Christian Europe were not quite as rational as Jaki would have his readers believe.

In a paper written for a volume dedicated to Torrance<sup>19</sup> Jaki made further comments about the nature of science. He gives a list of the names of those who, he believes, can be classes as "great discoverers" in science. In fact, the names he gives are restricted to those who have made great advances in physics (broadly interpreted, to cover astronomy, for example). He writes<sup>20</sup>:

They seem to have come in groups as science progressed. Planck and Einstein form one such group. Leucippus and Socrates would form the earliest of such

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<sup>16</sup>S.W. Hawking and G.F.R. Ellis: *The Large Scale Structure of Space-Time*. Cambridge University Press, Cambridge, 1973. Page xi.

<sup>17</sup>John C. Eccles: *The Human Mystery*. Springer-Verlag, Berlin, 1979. The Gifford Lectures at Edinburgh, 1978. Page 13.

<sup>18</sup>*Science and Creation*, page 192.

<sup>19</sup>Stanley L. Jaki: Theological Aspects of Creative Science. Pages 149–166 in McKinney, Richard W.A. (ed.): *Creation Christ and Culture: Studies in Honour of T.F. Torrance*. T. & T. Clark, Edinburgh, 1976.

<sup>20</sup>*ibid.*, page 153.

groups. The next group is that of Copernicus, Kepler, Galileo and Newton. With some reservations one can add another group, Faraday, Helmholtz and Maxwell. A total of less than a dozen names.

Commenting about these people he says<sup>21</sup>:

Contrary to the operationist and positivist clichés about the creators of exact science, their main concern was a vision of the whole cosmos, a vision steeped in the belief that the whole world was a unity kept together by rational laws. An equally important feature of that vision was that those rational laws could not simply be derived in a Platonic, or a priori fashion from the preferences of the mind.

Here he gives further evidence that he has not thought through his thesis with sufficient care. If the three names about which he expressed some doubt are omitted, the two Greeks, Leucippus and Socrates, represent a quarter of those classed as “great discoverers”. If we subtract Planck, whose ideas seem to have been more pantheistic than Christian, and Einstein, whose ideas are clearly more in line with deism than orthodox Judaism, only half of the number can reasonably be called Christian. And of these, Newton’s theological ideas were certainly far from orthodox!

In the concluding paragraph of the paper he mentions the classic proofs of the existence of God. He views the history of these as further evidence for the role of theology in “creative science”, for he writes<sup>22</sup>:

That history shows that all attacks on those proofs when unfolded in their full implication became attacks on the epistemology and world view which proved themselves to be essential ingredients in truly creative science.

Attacks on these proofs have come from two distinct quarters. Logicians have attacked them on purely logical grounds, amongst others on the final step from a sequence in the natural world to God (from a sequence of cause-and-effect to the First Cause; from a sequence of movers and moved to the Prime Mover); theologians, notably Barth, have denied that we can obtain any information about God, even his existence, outside of revelation. In neither case are “attacks on the epistemology and world view” necessarily involved.

Jaki delivered two series of Gifford Lectures at Edinburgh<sup>23</sup>. The first series, delivered in 1975, was entitled “Twice Twenty Centuries”. The second series, delivered in 1976, was entitled “The Twentieth Century”. The first series covers the development of science up to the nineteenth century, and the second, despite its title, takes the story up to around the middle of the twentieth century. In both these he paid rather more attention to theological issues than to scientific ones. He spends considerable effort discussing the traditional “five ways” of Aquinas — much of chapter 3 is devoted to this. A glance through the “Index of Names”, followed by a look at how they have been mentioned in the lectures, indicates that critics of these philosophical arguments are not highly regarded by Jaki. For example, from the first half of the alphabet we have Carnap, Comte, Diderot, Fichte, Hegel, Hobbes, Hume, Huxley (both T.H. and J.), Kant and Laplace. Even those who are normally regarded as

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<sup>21</sup>ibid., page 158.

<sup>22</sup>ibid., page 165.

<sup>23</sup>Stanley L. Jaki: *The Road of Science and the Ways to God*. University of Chicago Press, Chicago, 1978. The Gifford Lectures at Edinburgh, 1974–1976.

devout Christians do not escape — Roger Bacon comes in for criticism. The only ones who seem to escape criticism are those he mentioned in his paper in the Torrance honour volume.

He places great reliance on general relativity in these lectures — in fact rather more reliance than is warranted. His scientific information seems to be somewhat out-of-date. As just one example, chapter 12 is entitled “The Quantity of the Universe”. In this he deals with the size of the universe as revealed by modern work. His knowledge of historical matters relating to this seem to be faulty, for he writes:<sup>24</sup>

The homogeneous distribution of an infinite number of stars, the accepted picture of the cosmos from Newton’s time on, implied an infinite gravitational force on the basis of the inverse square law of gravitation. Scientific meaning could not therefore be secured for the cosmos as a whole in a Newtonian outlook . . .

In fact scientists were not nearly as united in their ideas as Jaki makes out. It was not until the 1920s that the existence of galaxies outside our own was demonstrated to the satisfaction of most astronomers.

At several points he comes perilously close to introducing his own God-of-the-gaps into his discussion. Chapter 16 is entitled “The Reach of the Mind”. In this he discusses such matters as the mind-body problem and artificial intelligence. Concerning the latter he writes:<sup>25</sup>

To the no small surprise of advocates of thinking machines, it was found that master chess players rely on a relatively few moves applied in successive phases of the game, which cannot be foreseen because of the unpredictability of the opponent’s moves. Herein lies the source of the chronic inability of programming computers to play chess with even moderate success, not in the staggering number of moves to be taken into account.

Any mention of what computers cannot do is always dangerous, since things change so rapidly. There are now computer chess programs which can defeat all but the greatest players. Jaki has not quite said that artificial intelligence is an impossibility, and that only God can produce intelligent beings, but he has come close to it.

The works discussed above are largely intended for the academic world. Jaki returned to his pet theme in a small book intended for more popular audiences<sup>26</sup>. There is very little in this which is not covered in more detail in his larger works.

A collection of his essays was published in 1986<sup>27</sup>. In this are reprinted two of his papers discussed above, “The Role of Faith in Physics”, and “Theological Aspects of Creative Science”. There are also chapters dealing with various people who have written about philosophical or religious aspects of science — Maritain, Chesterton, Goethe, C.P. Snow, and Duhem. But chapter 7, entitled “Knowledge in an Age of Science”, is the most interesting one in the book. This was the second of two lectures delivered at the University of Windsor in 1975. The first was entitled “A Hundred Years of Two Cultures”, and is included as chapter 6 in the book. In these Jaki attacks the attempts by social scientists to attain the same level of exactness in their disciplines as is possible in the physical sciences. He is highly critical of “the lure of physics”, and he labels the attempts of the social scientists “physicalism”. He is

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<sup>24</sup>ibid., page 189.

<sup>25</sup>ibid., page 259.

<sup>26</sup>Stanley L. Jaki: *The Origin of Science and the Science of its Origin*. Scottish Academic Press, Edinburgh, 1978.

<sup>27</sup>Stanley L. Jaki: *Chance or Reality and Other Essays*. University Press of America, Lanham, Maryland, 1986.

highly critical in particular of some sociologists and psychologists, and produces a parody of Psalm 23, using the language of behaviourism, which starts “The Lord is my external-internal integrative mechanism, I shall not be deprived of gratification”. He does not criticise theologians who attempt to make their study more rigorous by using the methods of the physical sciences, but the veiled unease is there.

He published a small book to celebrate the centenary of the commencement of the Gifford Lectures<sup>28</sup>. The bulk of the book is a list of the Gifford lecturers, a copy of Lord Gifford’s will, a reprint of an article “Recollections of a Brother”, and selections from some lectures delivered by Gifford himself. In his survey of the lectures themselves Jaki discusses the extent to which the lecturers have stuck to the intent of the bequest that the lectures be about “Natural Theology”. He interprets natural theology in a fairly restricted sense. However the will places very few restrictions on what can be discussed. The relevant section reads<sup>29</sup>:

... establishing in each of the four cities of Edinburgh, Glasgow, Aberdeen, and St. Andrews, a Lectureship or Popular Chair for ‘Promoting, Advancing, Teaching and Diffusing the study of Natural Theology,’ in the widest sense of that term, in other words, ‘The Knowledge of God, the Infinite, the All, The First and Only Cause, the One and Sole Substance, the Sole Being, the Sole reality, the Sole Existence, the Knowledge of His Nature and Attributes, the Knowledge of the Relations which men and the whole universe bear to Him, the Knowledge of the Nature and Foundation of Ethics or Morals, and of all Obligations and Duties thence arising’.

The last words here clearly leave matters wide open for almost any topic to be discussed. Jaki skims over the lectures in just 40 pages, so little is said about any specific lecturer. About Karl Barth he writes<sup>30</sup> “His Gifford lectures were an animated commentary on the Scottish Confession of 1560, ...”. On page 33 he writes:

Among scientist Gifford lecturers who made at least a brief reflection on natural theology, Polanyi, Hardy, and Thorpe represent positions worth considering to some extent.

His “consideration” of these amounted to a criticism of the empiricism he found in their writings. He shows that his main theme is still the origin of science in the Christian culture of Western Europe.

It is now possible to make an attempt at summarising Jaki’s ideas. It is quite clear that his main interest is historical. He has shown only a small amount of interest in general methodological issues, and concentrates on what he sees as the basis for all science — the belief held by early scientists about creation by a rational, transcendent, God. This is well expressed in the last paragraph in *Science and Creation*<sup>31</sup>:

All great cultures that witnessed a stillbirth of science within their ambience have a major feature in common. They were all dominated by a pantheistic concept of the universe going through eternal cycles. By contrast, the only viable birth of science took place in a culture for which the world was a created, contingent entity.

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<sup>28</sup>Stanley L. Jaki: *Lord Gifford and His Lectures: A Centenary Retrospect*. Scottish Academic Press, Edinburgh, 1987.

<sup>29</sup>ibid., page 72f.

<sup>30</sup>ibid., page 23

<sup>31</sup>*Science and Creation*, page 357.

This statement is historically true. But his hypothesis, essentially, is that science could *only* arise in such a culture. This he has not adequately defended.

# Chapter 4

## John Polkinghorne

My impression is that scientists are as likely to be religious believers as any other section of the community. Nevertheless there is a feeling abroad that somehow science and religion are opposed to each other. Someone like myself, who is an Anglican priest and a (now honorary) Professor of Theoretical Physics, is sometimes regarded either with the amazement appropriate to the strange mixture of the centaur or with the wariness appropriate to the sleight-of-hand artist.

John Polkinghorne<sup>1</sup>

John Charlton Polkinghorne was born in 1930<sup>2</sup>. He gained a Ph.D. from Cambridge University in 1955, a Sc.D. in 1974, and was elected a Fellow of the Royal Society of London in 1974. He has held various academic positions at universities. He resigned his position as Professor of Mathematical Physics at Cambridge University in 1979 to train for the Anglican ministry. He was ordained as deacon in 1981, and priest in 1982. At present he is President of Queens' College, Cambridge.

Polkinghorne is the most highly qualified of the three writers to speak about science (or at least about physics), since he is, at present, the only Fellow of the Royal Society who is in holy orders. He has published several small, but significant, books giving his ideas.

The first of these<sup>3</sup> was written because he could not find an elementary introduction to Christian doctrine which, he felt, was suitable for his academic colleagues. In the first chapter, entitled "Apologia", he describes how he came to move from academic work in physics to the Christian ministry<sup>4</sup>

As I approached my fiftieth birthday I was conscious that some change of activity was becoming necessary. As I talked it over with my wife, I reached the really rather surprising conclusion that I should seek to train for the ordained ministry of the Church. I have always stood within the community of the Christian faith, and Christianity has always been central to my life. However it did not necessarily follow from that, of course, that I should turn my collar round. I had regarded the period I had spent as a particle physicist as a Christian vocation, and I still do.

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<sup>1</sup>John Polkinghorne: *One World: The Interaction of Science and Theology*. SPCK, London, 1986. Page xi.

<sup>2</sup>Biographical information taken from *Who's Who*, 1990, page 1448.

<sup>3</sup>John Polkinghorne: *The Way the World Is*. Triangle SPCK, London, 1983.

<sup>4</sup>*ibid.*, p. 1.

The book is almost entirely theological, and in the first chapter he gives an outline of its theme<sup>5</sup>:

Part of my reason for being a Christian is that I believe that a Christian understanding offers us such a coherent framework, adequate to the perplexing way the world is. I have had the temerity to attempt to write the book which I could not find in the bookshops. It is my personal *apologia* for the faith I hold.

His other three major writings form a trilogy. The first<sup>6</sup> presents a general outline of science and theology, and emphasises the need to consider many levels of description in any discussion about human beings. He spells this out in detail in the concluding chapter<sup>7</sup>:

Reality is a multi-layered unity. I can perceive another person as an aggregation of atoms, an open biochemical system in interaction with the environment, a specimen of *homo sapiens*, an object of beauty, someone whose needs deserve my respect and compassion, a brother for whom Christ died. All are true and all mysteriously coinhere in that one person. To deny one of these levels is to diminish both that person and myself, the perceiver; to do less than justice to the richness of reality. Part of the case for theism is that in God the Creator, the ground of all that is, these different levels find their lodging and their guarantee. He is the source of connection, the one whose creative act holds in one the world-views of science, aesthetics, ethics and religion, as expressions of his reason, joy, will and presence.

Throughout the book he emphasises the way knowledge, scientific or theological, should be treated as a unity.

The second in the series<sup>8</sup> is based on the Margaret Harris Lectures in Religion he delivered at the University of Dundee in 1987. As the subtitle suggests, it deals largely with the way scientists and other people go about looking for ways of understanding the enormous complexity of the world around us.

The third in the series<sup>9</sup> continues “the search for understanding” started in the previous book. It takes up the issues of how divine providence, miracles, evil and intercessory prayer can be integrated with a scientific understanding of the universe.

Since the points of view contained in *One World* are, in general, expanded in the later works, it is worth giving a somewhat extended treatment of its major ideas. The overall theme he spells out in the Preface<sup>10</sup>

In fact science and theology seem to me to have in common that they are both exploring aspects of reality. They are capable of mutual interaction which, though at times it is puzzling, can also be fruitful. This book is written to defend that thesis.

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<sup>5</sup>ibid., page 5.

<sup>6</sup>Polkinghorne, John: *One World: The Interaction of Science and Theology*. SPCK, London, 1986. Referred to subsequently as *One World*.

<sup>7</sup>ibid., page 97.

<sup>8</sup>John Polkinghorne: *Science and Creation: The Search for Understanding*. SPCK, London, 1988. Referred to subsequently as *Science and Creation*.

<sup>9</sup>John Polkinghorne: *Science and Providence: God's Interaction with the World*. SPCK, London, 1989. Referred to subsequently as *Science and Providence*.

<sup>10</sup>*One World*, page xi.

This places his work squarely within Proudfoot's category 6 (see page 2 above). After an introductory chapter there are four chapters, of roughly equal length, entitled "The Nature of Science", "The Nature of Theology", "The Nature of the Physical World", and "Points of Interaction". A briefer chapter, "Levels of Description", follows, and then the concluding chapter. These are all quite brief, and are perhaps too concise for the average reader with little familiarity with either science or theology.

In "The Nature of Science" he concentrates on providing a very brief outline of the way science has obtained more and more accurate information about the laws of nature. He writes<sup>11</sup>

Our powers of rational prevision are pretty myopic and limited by the contingency of the way things are, existing independently of how we think they ought to be. The natural convincing explanation of the success of science is that it is gaining a tightening grasp of an actual reality. The true goal of scientific endeavour is understanding of the structure of the physical world, an understanding which is never complete but ever capable of further improvement. The terms of that understanding are dictated by the way things are.

That is the realist position. . . . The realist view, it seems to me, is the only one adequate to scientific experience, carefully considered.

He illustrates this by referring to the discovery of Neptune, when the orbit of Uranus was found not to be in agreement with that predicted using Newton's law of gravity and the then known planets. He mentions that a similar exercise with the orbit of Mercury was unsuccessful, and *that* problem was only solved with the development of general relativity by Einstein.

When he comes to consider "The Nature of Theology", his main point is that theology, like science, should be prepared to change. He writes<sup>12</sup>

The Christian creeds are summaries of the Church's insights into her experience of God, but each generation has to make them its own to the extent that it can. Theology, like science, is corrigible.

He then presents his personal ideas about theology<sup>13</sup>

The view of the theological enterprise which I would wish to defend is summed up in a splendid phrase of St Anselm: *fides quaeres intellectum*, faith seeking understanding. Thus conceived, theology is reflection upon religious experience, the attempt to bring our rational and ordering faculties to bear upon a particular part of our interaction with the way things are.

He spends a brief amount of space on specifically theological issues. he then moves on to consideration of interactions between theology and science. He starts this section by stating a major difference between science and religion: in science, he says, we are dealing with things which we, in some sense, transcend; in religion we are dealing with a person who transcends us. Thus we can never expect to have the same kind of knowledge about God that we may obtain about the natural world. The next point he takes up is the use of reason within theology. He expresses his thoughts on this in the words<sup>14</sup>

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<sup>11</sup>ibid., page 22.

<sup>12</sup>ibid., page 28.

<sup>13</sup>ibid.

<sup>14</sup>ibid., page 35.

The second thing to say is that the inevitable mystery in the nature of God is not a licence for irrational assertion about him. Reason has its limitations, but it is not to be trifled with.

He spends some time discussing the use of reason. He then mentions the differing natures of the object of study in the two fields<sup>15</sup>

Theology and science differ greatly in the nature of the subject of their concern. Yet each is attempting to understand aspects of the way the world is. There are, therefore, important points of kinship between the two disciplines. They are not chalk and cheese, irrational assertion compared with reasonable investigation, as the caricature account would have it.

He then mentions four specific qualities which theology should have if it to have any claim to intellectual respectability. These are (i) coherence; (ii) economy; (iii) adequacy; and (iv) existential relevance. He says that he is indebted to J.R. Carnes' book *Axiomatics and Dogmatics* for these. Under "coherence" he claims that the theological enterprise must hang together, even though it may, like science, have to live with some untidy ends. Under "economy" it must not introduce additional explanations each time a problem appears; Occam's razor, in fact. Under "adequacy" he says it must be rich enough to be able to discuss any matters of concern. Finally, under "existential relevance" it must be linked with religious experience; it must not be a purely academic exercise. He points out that these purely religious ideals have a great deal in common with the scientific enterprise. The remainder of the chapter covers something of the way theological data is assessed.

When he comes to chapter 4 on "The Nature of the Physical World" he lists ten different qualities which characterize the natural world. He discusses each of these, devoting between half a page and five pages to them depending on the importance of the particular quality. In order, the qualities are: 1. elusive; 2. intelligible; 3. problematic; 4. surprising; 5. chance and necessity; 6. big; 7. tightly-knit; 8. futility; 9. complete; 10; incomplete. Most of these sections deal with specifically scientific topics, and are not directly relevant to theological issues. However sections 6 ("big"), 8 ("futility") and 10 ("incomplete") do contain some issues of relevance and brief comments on them are warranted.

In section 6 he deals with the enormous size (spatially) of the universe which has been revealed by astronomy since the 1920s. The problem of the significance of the human species has become critical. That God should be interested in one particular planet has been likened to an interest in one specific grain of sand out of all those on all the beaches in the world. Humanity pales into insignificance on the cosmic scale. Polkinghorne responds to this in the next section ("tightly-knit") where he mentions the anthropic principle.

In section 8 he considers the two possible alternatives for the future of the universe. The first is continued expansion, leading eventually to what has been called the "heat death" of the universe, when the galaxies (eventually) turn into black holes which then, over an even longer time scale, evaporate, leaving a universe in which gradually cooling radiation is the only thing left (it is now, on average, only three degrees above absolute zero, and getting colder). The other alternative is that the expansion of the universe will eventually stop, and be succeeded by a contraction, leading (eventually) to the collapse of the universe into the "big crunch". Both these scenarios seem equally bleak from the traditional Christian perspective.

In section 10, with reference to the "incomplete" nature of the physical world, he writes<sup>16</sup>

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<sup>15</sup>ibid., page 36.

<sup>16</sup>ibid., page 60.

It [science] restricts itself to certain kinds of inquiry, and in consequence much that is of the highest significance eludes it. . . . The real gap is between talking about complex metastable systems and talking about people. There is more to the world than physics can ever express.

Although Polkinghorne's work generally falls within Proudfoot's category 6 (see page 2 above), in these sentences he shows that he sees category 4 (value and significance) as also important to the distinction between scientific and religious ways of thought.

In chapter 5, "Points of Interaction", he mentions four specific points at which conflict could easily arise between scientific and theological approaches to the physical world. These he treats at greater length in subsequent books, but some of the points he raises are worth mentioning here. The four areas are: (i) origins; (ii) God's interaction with the world; (iii) miracles; and (iv) future life. Of these (iii) is really a part of (ii), and science has very little to say about (iv). As far as "origins" are concerned, he points out the major problem for theology<sup>17</sup>:

Theology has always been in danger of a double bind in relation to physical causation. A tightly deterministic universe, evolving along predetermined lines, seems to leave little room for freedom and responsibility. It is congenial only to a deistic indifference or to the iron grip of Calvinist predestination. On the other hand, too loose a structure dissolves significance. meaning can drown in the rising waters of chaos.

It is essentially this point over which most of the argument has raged. The traditional problems of miracles, the existence of evil, and the purpose of petitionary prayer are all associated closely with the existence or otherwise of determinism. Polkinghorne wisely does not spend a great deal of space in this book dealing with these issues.

In the section on "God's interaction" he starts by mentioning one important aspect of Christian practice, petitionary prayer. He discusses how this might be related to the deterministic world picture, starting with the words<sup>18</sup>:

It is one thing to pray for strength in time of personal need. It is something entirely different to pray for rain or for the healing of an inoperable cancer pronounced terminal by the doctors. . . . There are clashes of interest; the farmer's desire for rain opposes the vicar's hope of a dry day for the church fete.

This problem, and a variety of others, are considered in more detail in *Science and Providence* discussed later in this essay.

The content of his next book, *Science and Creation*, is adequately described by the subtitle, "The Search for Understanding". In the preface he suggests that in any such search religion needs to be included<sup>19</sup>:

Nevertheless the search for understanding will be incomplete if it does not include within itself the religious quest, for otherwise it will leave fundamental questions of significance and purpose unaddressed and unanswered. Here is the point of continuity between the life of the physicist and the life of the priest, or better, between the scientific and theological questionings always contemporaneously present within one person.

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<sup>17</sup>ibid., page 69.

<sup>18</sup>ibid., page 70.

<sup>19</sup>*Science and Creation*, pages xi, xii.

He then goes on to speak of natural theology as an “indispensable part of theological inquiry”. The core of the book is chapter 3, “Order and Disorder”; chapter 4, “Creation and Creator”; and chapter 5, “The Nature of Reality”. In these he shows that natural theology is still possible in the modern scientific world.

In “Order and Disorder” he uses modern nonequilibrium thermodynamics, established largely by Ilya Prigogine, to illustrate the fact that order can arise spontaneously from randomness and disorder. He suggests that disorder in the world is not necessarily incompatible with religion, since it may give rise to order at some stage. This is an argument by analogy, rather than a strictly logical one. In “Creation and Creator” he speaks about the continuing involvement of the Creator with his creation<sup>20</sup>:

The one who is faithful must show reliability in his relationship with his world. He will not be an arbitrary intervener in its processes but they will have about them a consistency which reflects his character. . . . The God of love can be no cosmic puppet master, pulling the strings of a world which is totally subservient to him.

It is clear that the balance between these internal constraints is a delicate one. Faithfulness might be expected to find its expression in order, but a genuine freedom granted to the world opens up the possibility of disorder. . . . The world created by a God of love may be expected to be characterised both by the openness of chance and the regularity of necessity.

We are here getting close to a partial theological understanding of order and disorder in the natural world, with a veiled criticism of Monod’s popular book *Chance and Necessity* in the last few words here. He speaks about the erroneous idea many Christians have about the nature of creation, arising from an undue emphasis on the first two chapters of Genesis<sup>21</sup>:

Too great a concentration on the first two chapters of Genesis, or an inadequate interpretation of them, has sometimes mislead Christians into placing undue emphasis on a doctrine of creation conceived of as a doctrine of temporal origin. Hence the erroneous thought that big bang cosmology, with its dateable point of departure for the universe as we know it, has a superior value for theology over the steady-state theory, which essentially supposed the universe to be everlasting.

The remainder of the chapter covers some of the ideas by scientists and theologians which Polkinghorne sees as inadequate. Here he is largely clearing the ground for later work. In “The Nature of Reality” he discusses the way science is gaining an increasing understanding of the way the natural world works. He spends some time discussing the way various abstruse fields of mathematics have been found useful in explaining the behaviour of elementary particles. He claims that the fact that the logical structure of mathematics bears such a close relationship to the real world indicates that the entities the theoretical physicist deals with (quarks, gluons, etc) are real entities, and not just convenient ways of describing phenomena. He insists that the successes of modern particle physics provide further support for the hypothesis that the universe was created by a rational God.

After setting the ground with his earlier works, in *Science and Providence* Polkinghorne gets down to the nitty-gritty of how we can put together a world-view which is adequate for our modern scientifically based, high technology, culture. Any such world view will need

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<sup>20</sup>ibid., pages 51f.

<sup>21</sup>ibid., page 54.

to take science into account properly, and not brush theology aside. In the Introduction he writes about his earlier two books<sup>22</sup>:

Both were necessarily concerned with the generalities of physical process. In consequence the God of whom they spoke could as well have been the God of deism as the God of Christianity. The latter differs from the former in his personal and particular concern for the unfolding histories of his creatures. . . . The purpose of this book is to consider whether such a personal, interacting, God is a credible concept in this scientific age.

The nine chapters in the book are entitled: “The Problem”; “Embodiment and Action”; “Providence”; “Miracle”; “Evil”; “Prayer”; “Time”; “Incarnation and Sacrament”; and “Hope”. Since the book contains less than 100 pages of text each of these topics can only have a fairly cursory treatment. Since the major point at issue is how God *can* interact with the world, Polkinghorne’s ideas on this will be presented. Then two of the major topics, miracles and prayer, will be discussed briefly.

He explains his theme in the introductory chapter, “The Problem”<sup>23</sup>:

The picture of the divine clockmaker, from time to time interfering to adjust the hands of the steadily ticking cosmic clock, is not one that commends itself to Christian theology. God’s relationship with the world must be continuous and not intermittent; it can have nothing capricious about it, but it must be characterised by the most profound consistency. . . . Those regularities discerned by science as the laws of nature are, in fact, signals of God’s reliability and faithfulness, made known in his creation.

These words are an expansion of his ideas about the same subject in his previous book. They are also a sly dig at Newton, who envisaged God stepping in from time to time to adjust the orbits of the planets, so that their mutual gravitational interactions did not disturb the orbits too much.

The chapter “Embodiment and Action” contains the basis of his arguments about the possibility of God interacting in a deterministic universe. Thus his ideas expressed here need to be examined in some detail. From time to time an advance in a field of science catches the attention of the general public. This happened in 1919 when observations of a solar eclipse showed that Einstein’s prediction about the bending of rays of light passing the sun was more accurate than Newton’s mechanics. It has happened again recently with the rise of study of systems which can have unexpectedly complex behaviour, which has been labelled, rather misleadingly, “chaos”. Various TV programmes and popular books present some of the ideas of this topic. One of the books uses Einstein’s remark about quantum mechanics as a basis for the title, and the author writes in the Prologue<sup>24</sup>:

The very distinction he [Einstein] was trying to emphasise, between the randomness of chance and the determinism of law, is called into question. Perhaps God can play dice, and create a universe of complete law and order, at the same time.

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<sup>22</sup>*Science and Providence*, page 1.

<sup>23</sup>*Science and Providence*, page 6.

<sup>24</sup>Ian Stewart: *Does God Play Dice? The Mathematics of Chaos*. Basil Blackwell, Oxford, 1989. Page 2.

The essential point about the whole subject is that there are many fairly simple mathematical models of completely deterministic phenomena in the real world which can show unexpectedly complicated behaviour. From the theological viewpoint the most significant is the extreme sensitivity shown to slight changes in the starting point. This has been labelled the “butterfly effect” — a butterfly flapping its wings today can disturb the atmosphere so that a storm develops next month, which would not otherwise have done so. If we knew the exact positions and speeds of all the particles involved we would, in principle, be able to calculate what was going to happen in the future. But calculations, even on the most powerful computers, can only be of limited accuracy. Since we cannot know both the position and the speed of even a single particle *exactly* at any particular instant (from Heisenberg’s uncertainty relation) we cannot, in practice, calculate the future. The essential point behind Stewart’s remark is that since we cannot know *exactly* how dice are thrown, the outcome appears “random” (in some sense) to us. But since God is not limited in this way, complete law and order are, in a sense, compatible with him playing dice — there is nothing “random” about the outcome as far as he is concerned. In fact Stewart goes as far as to write<sup>25</sup> “The question is not so much *whether* God plays dice, but *how* God plays dice” [Stewart’s emphasis].

Polkinghorne takes up this point near the start of his discussion on providence<sup>26</sup>:

This is not the place to attempt to describe dynamical instabilities or the theory of chaos. It is sufficient to say that these modern dynamical insights do not result in just a descent into disorder but they also assert the possibility of the generation of a new order within their process . . . We see emerging from this study of the dynamics of complex systems just those characteristics of structured openness which seem to offer hope that those super-complex systems, which are ourselves, might indeed manifest the freedom within regularity which is our basic human experience. And might one not go on to suppose that similarly the super-super-system of the cosmos might be capable, in an analogous way, of sustaining the operation of the acquiescent, economic and purposive wills of its Creator, within the flexibility of its lawful process?

It is not entirely clear just what Polkinghorne intends by these words. With his references to “openness” he seems to be saying that determinism no longer holds. This is taking things rather too far, unless there are some appropriate qualifications attached. It is not determinism, as such, which has been undermined by research into “chaos”, but our ability to make long-term predictions about the outcomes of some deterministic processes.

There is a hint here that Polkinghorne has fallen into a rather subtle “God of the gaps” trap. His reference to “the cosmos . . . sustaining the operation of the . . . purposive wills of its Creator, within the flexibility of its lawful process” comes very close to putting God into the gaps in our predictive ability which science has now forced upon us by studies in the field of chaos. He does, of course, heavily qualify his statement by the words “might not one go on” and “analogous”. Nevertheless a slight feeling of unease remains. His statements seem rather too close to appeals to the “uncertainty principle” in quantum mechanics, used in the 1920s and 1930s, for this writer, at least, to be comfortable with them.

He then goes on to talk about microscopic systems, where Heisenberg’s uncertainty principle is vital, and we can only calculate probabilities of events, not certainties. He then compares these results with those of large-scale systems<sup>27</sup>:

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<sup>25</sup>ibid.

<sup>26</sup>*Science and Providence*, pages 29f.

<sup>27</sup>ibid., page 30.

Of course, a considerable extrapolation is needed beyond what we comprehend in order to reach an understanding of the capacity for human or divine action. . . . We now understand that even at those macroscopic levels where classical physics gives an adequate account, there is an openness to the future which relaxes the unrelenting grip of mechanical determinism. The universe may not look like an organism, but it looks even less like a machine.

Again, this is going beyond the available scientific data. On the cosmic scale of distance and time the universe appears to follow Einstein's equations of general relativity, and these are completely deterministic. In the next paragraph he says<sup>28</sup>:

A consequence of the decay of predictability is a freedom for development, which enables physics to accommodate not only the idea of being (the timeless regularity of physical law) but also becoming (the evolving history of complex systems). The future is not already implied by the present.

Polkinghorne is correct to speak about "the decay of predictability", but this does not necessarily imply that there is freedom, of any sort, for development in the future. The final sentence should read "*Our knowledge of the future is not already implied by our knowledge of the present*". There is a rather deep philosophical problem involved in any discussion about systems which have chaotic behaviour, or even about determinism in general. Ideas on determinism arose out of Newton's work on mechanics. He treated only fairly simple systems. However, as mentioned earlier, when it comes to deducing general results for more complicated systems, we may very well not be able to decide, from a purely scientific approach, whether a particular system under investigation is genuinely deterministic or not. But none of this gives any grounds for suggesting that God can interact with the cosmos, simply because of the limitations on our predictive ability.

After Polkinghorne's initial presentation of his general ideas, he gets down to how they might be applied in various practical situations. Here consideration will be restricted to how he deals with just two topics, taken from his chapters on "Miracle" and "Prayer". In both these chapters the topics are treated in two parts. In the first part he deals with the *possibility* of miracles, or of petitionary prayer being effective. In the second part he deals with how one might interpret evidence claimed to be in favour of these.

In chapter 4, "Miracle", he starts by emphasising that a miracle is not just a very odd event<sup>29</sup>:

A miracle is not just an astonishingly odd event, such as would be the sudden materialization in Trafalgar Square of a twelve-foot-high statue of Nelson made of chocolate. It also has to be a carrier of meaning.

Over the next few pages he expands on the theme of the laws of nature being expressions of God's reliability and rationality. He argues against the use of the word "interference" as an appropriate way of describing God's action in what are commonly called "miracles". He also argues against the idea that the miraculous may be regarded as a kind of accelerated version of the natural. He illustrates this by comparing the turning of water into wine at the wedding at Cana with the slow growth of grapes, and the biochemical processes of fermentation. The former is clearly *not* an accelerated case of the latter. He suggests that

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<sup>28</sup>ibid.

<sup>29</sup>ibid., page 45.

some “miraculous” happenings may be more akin to “arranged coincidence” than to miracles as usually understood. The significance of the event may lie more in the coincidence than in anything of a supernatural nature<sup>30</sup>:

There are causal chains, lawfully propagating in the world, whose impingement upon each other can produce a situation of apparent significance.

This is certainly a possibility, but there are formidable problems in attempting to check any such claim. It is almost impossible to calculate the probability of the occurrence of various events in the world, let alone the probability of coincidences. There is then the even more difficult task of calculating whether such coincidences happen more often than expected for those who are particularly devout, or spend more time praying.

He then goes on to consider what may more properly be called “miracles”, which involve events of a character which seem to conflict with the “laws of nature”. This is the weakest part of the chapter. He relies largely on the foundation he laid earlier, about the lack of determinism in the universe. But since his foundation is rather unsafe, so too are any conclusions based upon it. He criticises Hume’s arguments against miracles by showing that Hume was so biased against the miraculous that he discounted any evidence for miracles. Polkinghorne mentions briefly the central miracle of Christianity, the resurrection, and refers readers to chapter 8 of his theological book *The Way the World Is* for further discussion. He falls back on the transcendence of God, and says that the activities of the creator of the universe, “though always utterly consistent, may sometimes be totally unexpected”<sup>31</sup> This is not entirely satisfactory. It comes close to introducing a god-of-the-gaps again.

He starts chapter 6, “Prayer”, by writing<sup>32</sup>

One could hardly imagine oneself asking the God of deism for anything. One might well adore him for his mighty act of creation but one could not expect him to do anything about individual happenings within its process. . . . petitionary prayer implies belief in a God who acts in the particular as well as in the general.

He then discusses Augustine’s comment that in prayer we are preparing ourselves to receive what God is going to give. Using as a basis the claimed lack of absolute determinism within the universe, he puts the issue in the words<sup>33</sup>:

The room for manoeuvre that exists for the accomplishment of divine and human ends through cosmic process, will surely be enhanced by the collaborative alignment of God’s will and ours which lies at the heart of petitionary prayer.

But here again, as with miracles, the claimed basis is not as sound as he makes out. He uses as a metaphor the “coherence” of light from a laser. Here the light waves emitted from each atom are all in step, rather than random, and give a very intense light. However there are considerable difficulties about the application of this to prayer, as it is generally understood. The problem of the farmer praying for rain, and the vicar for a fine day, mentioned earlier, is one. A more serious one might be the prayers offered by two opposing sides in a major war. This part of this chapter is not very satisfactory.

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<sup>30</sup>ibid., page 48.

<sup>31</sup>ibid., page 58.

<sup>32</sup>ibid., page 69.

<sup>33</sup>ibid., pages 70f.

His discussion of how the efficacy of prayer might be determined is rather better. He mentions Francis Galton's inconclusive investigation of prayers offered for royalty and clergy. He dismisses this as misguided, since the interpretation of whether or not a prayer has been answered is really a matter of private interpretation. This is yet another example of the use of "personal knowledge" in the religious sphere. Thus Polkinghorne sees prayer being more applicable to the individual religious life rather than the corporate life of the church.

Polkinghorne seems, overall, to be content to live in a state of more or less "uneasy truce", as Habgood suggested in 1962. He expresses this throughout his writings, but particularly in one passage in *One World*<sup>34</sup>:

It is the sign of a mature subject to be able to be true to experience however hard that experience may be to understand. Better a confused state of loyalty to the facts than a tidy theory obtained by Procrustean over-simplification. One cannot tell the wave-particle story of quantum mechanics without thinking of the God-man duality of Christ. If Christian experience finds in Jesus elements both human and divine, as I believe it does, then it must hold fast to that experience whatever the intellectual problems involved. We live in a subtle world and both science and theology need to be subtle in their account of it.

Polkinghorne clearly has Einstein's phrase "The Lord God is subtle, but he is not malicious" in mind at this point. His mention of maturity covers the essence of the whole of his writings about science and religion. If science and religion are to be regarded as fields of study which have reached some degree of maturity, they will both be able to regard, with appropriate respect, any evidence which is produced, provided the evidence has been obtained in an appropriately rigorous manner. Neither will wish to disregard evidence obtained by the other. They are to run in parallel, and to learn from each other.

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<sup>34</sup>*One World*, page 84.

# Chapter 5

## Thomas Torrance

In this light it becomes evident that natural theology may offer the greatest hindrance to natural science and to scientific theology alike.

Thomas F. Torrance<sup>1</sup>

Thomas Forsyth Torrance was born in 1913<sup>2</sup>. He gained an M.A. from the University of Edinburgh in 1934, a B.D. in 1937, a D.Th. from the University of Basel in 1946, and a D.Litt. from Edinburgh in 1971. He was ordained in the Church of Scotland in 1940. He was Moderator of the General Assembly of the Church of Scotland in 1976–77. He was awarded the Templeton Prize for religious writing in 1978. He is retired, but holds the title of Emeritus Professor of Christian Dogmatics of the University of Edinburgh. In 1976 a collection of studies in his honour was published<sup>3</sup>.

Torrance is a very prolific writer. The recent bibliography of his works<sup>4</sup>, although containing some duplications, extends to 38 pages. It is thus quite impossible to give an adequate coverage of his ideas within the space of this essay. Only some major themes will be mentioned, and reference made to only a small selection of his works.

His earliest writings are very conservative theologically. The second item listed in the bibliography of his works was issued by the Theological Students' Prayer Union of the Inter-Varsity Fellowship of Evangelical Unions in 1941<sup>5</sup>. This extremely conservative (though not fundamentalist) organisation had been set up about 15 years earlier in opposition to the Student Christian Movement, which some saw as being far too liberal in tone. However his conservative theology did not prevent him taking a great interest in, and appreciation for, the works of Karl Barth. He expresses part of this in the introductory sentence in the preface to a collection of his essays<sup>6</sup>:

The various essays which make up this volume have arisen out of a sustained engagement with the tension between Christian theology, as it has been renewed directly or indirectly through the great work of Karl Barth, and the general frame of thought that has dominated European culture for several hundred years.

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<sup>1</sup>Thomas F. Torrance: *Theological Science*. Oxford University Press, Oxford, 1969. Page 102.

<sup>2</sup>Biographical information taken from *Who's Who*, 1990, pages 1822, 1823.

<sup>3</sup>Richard W.A. McKinney (ed.): *Creation Christ and Culture: Studies in Honour of T.F. Torrance*. T. & T. Clark, Edinburgh, 1976.

<sup>4</sup>Iain R. Torrance: A bibliography of the writings of Thomas F. Torrance 1941–1989. *Scottish Journal of Theology*, vol. 43 (1990), pages 225–262.

<sup>5</sup>*ibid.*, page 225.

<sup>6</sup>Thomas F. Torrance: *Transformation and Convergence in the Frame of Knowledge: Explorations in the Interrelations of Scientific and Theological Enterprise*. William B. Eerdmans Publishing Company, Grand Rapids, Michigan, 1984. Referred to subsequently as *Transformation and Convergence*.

This interest eventually led to him becoming joint editor of the English translation of Barth's *Church Dogmatics*. However, after he joined the staff of the University of Edinburgh in 1950 it also led to strife with his evangelical friends, as reported by Bebbington<sup>7</sup>:

... the Edinburgh University Christian Union, which came under the influence of the Barthian theology of Professor T.F. Torrance and so was disaffiliated in 1953 by the Inter-Varsity Fellowship.

This was in the days when conservatives were still very suspicious of anything which came from German theologians. Such an action would be unlikely today, with the greater appreciation of Barth's work.

However this did not deter Torrance, and in his earlier writings on science and religion he makes frequent, usually approving, references to Barth. The style of his writing, with its fairly long, sometimes convoluted, sentences, may owe something to Barth's rather turgid style.

Up until around 1960 his interests seem to have been almost entirely theological, with emphasis on liturgical and sacramental issues. In 1959 he was invited to give the Hewett Lectures at Union Theological Seminary, New York, and several other theological institutions in USA. These lectures were published, in revised form, in 1969<sup>8</sup> In this he is firmly committed to Barth's ideas about God revealing himself to human beings<sup>9</sup>

Unless we have a Word from God, some articulated communication from Himself to us, we are thrown back upon ourselves to authenticate His existence and to make Him talk by putting our own words into His mouth and by clothing Him with our own ideas. That kind of God is only a dumb idol which we have fashioned in our own image and into whose mouth we have projected our own soliloquies, and which we are unable to distinguish from our own processed interpretation. In other words, we have no genuine knowledge of God at all, for we are left alone with our own thoughts and self-deceptions.

These sentiments are almost pure Barth. His appreciation for Barth did not flag, and references may be found to many of Barth's ideas in later works.

However he also showed, in the same work, that he was aware that theology could not go its own way, completely ignoring what science has revealed about the way the natural world works. He mentioned specifically the relation between God and what had been created. He also emphasised, as has Jaki, that modern science owes its origin to the Christian belief in creation by one God. He also covers one of the themes in Polkinghorne's works, that the intelligibility of the universe arises out of the reliance we can place on God not to act perversely<sup>10</sup>:

Theology is concerned with God as the Creator of the world, and therefore with God in His relation to the world of creaturely realities. ... That is the reason for the peculiar interest of theology in the rise and progress of natural science, and for the fact that its own scientific pursuit cannot be separated from the scientific

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<sup>7</sup>D.W. Bebbington: *Evangelicalism in Modern Britain: A History from the 1730s to the 1980s*. Unwin Hyman, London, 1989. Pages 254f.

<sup>8</sup>Thomas F. Torrance: *Theological Science*. Oxford University Press, Oxford, 1969.

<sup>9</sup>ibid., page 31.

<sup>10</sup>ibid., pages 56f.

pursuits that are pursued in the same world about other aspects of creaturely being. This is indeed why, in spite of the unfortunate tension that has so often cropped up between the advance of scientific theories and traditional habits of thought in the Church, theology can still claim to have mothered throughout long centuries the basic beliefs and impulses which have given rise especially to modern empirical science, if only through its unflagging faith in the reliability of God the Creator and in the ultimate intelligibility of His creation.

He provides no evidence for his claim about “. . . the peculiar interest of theology in the rise and progress of natural science”. He seems to have in mind Europe after the Reformation, when there was an upsurge in science, particularly astronomy. However this “interest” has not always led to amiable relations between science and theology, as White has documented<sup>11</sup>.

Later in the book he wrote about the need to consider different levels of understanding. This is one of the main themes in Polkinghorne’s later works. Torrance was wary of using the different levels of understanding in science as a basis for natural theology<sup>12</sup>:

In our natural science we operate with sequences in which precedence and subsequence belong to the same series on the same level of existence, but does this connection obtain between contingent realities that are dependent on what lies beyond them and the ultimate Reality that is only in and through itself? Even when we argue that it is the contingency of creaturely realities upon the Ultimate that gives them their meaning and enables us to grasp their natural and inherent connections, does it follow that we can project these connections univocally to take in the Ultimate as if He could be known through an infinite extension of our natural sequences?

His reference in the last phrase is probably to the “five ways” of Aquinas. The first of these used the idea of a sequence of movers, and worked back to the “Prime Mover”. The second discussed the cause-effect relationship, and worked back to the “First Cause”. The fourth considered successive levels of attributes such as beauty and goodness, and worked back to the “Supreme Good”. Aquinas excluded the possibility of any of these sequences being of infinite length. However this needs to be taken as one of the axioms of reasoning, and is not self-evident. Even if the logical reasoning is accepted, Torrance doubts whether this would lead to any knowledge of God. Here he seems to agree with the Jesuit, F.C. Copleston, who wrote<sup>13</sup>:

The difficulty, therefore, which may be experienced in regard to Aquinas’ proofs of God’s existence concerns not so much the empirical facts or alleged empirical facts with which he starts as in seeing that these facts imply God’s existence.

Torrance does not completely reject all possibility of natural theology, as Barth did. However he clearly places severe restrictions on its usefulness.

In the same year that *Theological Science* was published there appeared his work *Space, Time and Incarnation*<sup>14</sup> This was the first of two aimed at trying to give some understanding

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<sup>11</sup>Andrew Dickson White: *A History of the Warfare of Science with Theology in Christendom*. Peter Smith, Gloucester, Massachusetts, 1978. Originally published in 1896. *passim*

<sup>12</sup>*Theological Science*, page 299.

<sup>13</sup>F.C. Copleston: *Aquinas*. Penguin Books, Harmondsworth, Middlesex, 1955. Page 117.

<sup>14</sup>Thomas F. Torrance: *Space, Time and Incarnation*. Oxford University Press, Oxford, 1969.

of how a transcendent God can interact with the finite space and time in which we live. The second took up the other main interaction of God with the world (apart from the initial creation), the resurrection<sup>15</sup>. In both of these he made considerable use of the four dimensional space-time continuum which Einstein found essential as a basis for general relativity. Torrance frequently referred to the way time and space could not be treated separately, but needed to be dealt with together. In this he was rather running ahead of scientific verification. At this time (1969) experimental evidence for the validity of general relativity was rather weak<sup>16</sup>, and it is only fairly recently that other theories have been abandoned. Although general relativity has passed all the tests which have been devised so far, with flying colours<sup>17</sup>, it can still be very dangerous for theology to be too closely wedded to a particular scientific theory — there is always the possibility (some would say likelihood, or even certainty) of divorce in the next generation.

Torrance makes some use of the prediction of relativity that the universe had an origin at some finite time in the past. Of course Augustine<sup>18</sup> had argued much earlier that time was coextensive with the universe, and did not precede it. Unlike Jaki, Torrance does not argue, at least in these books, for a finite spatial extent of the universe. His main point is that we can no longer regard the universe as some sort of spatial container into which God comes in the person of Jesus.

The first two chapters in *Space, Time and Incarnation* examine the way spatial concepts have been handled in (a) Nicene theology, and (b) Reformation and modern theology. These contain little of direct interest to modern science. He mentions the way Newton's ideas of space and time paved the way for deism. He criticises Bultmann's demythologizing programme for "... his deistic assumption that God does not interact with this world"<sup>19</sup>. The third and final chapter in the book, "Incarnation and Space and Time", presents his main ideas about how the incarnation can be related to modern scientific understandings. Fairly early in the chapter he introduces his ideas on creation<sup>20</sup>:

The Christian doctrine of Creation asserts that God in His transcendent freedom made the universe out of nothing, and that in giving it a reality distinct from His own but dependent on it He endowed the universe with an immanent rationality making it determinate and knowable. . . . nature by itself speaks only ambiguously of God, for while it may be interpreted as pointing intelligibly beyond itself to God, it does not permit of any necessary inferences from its contingency to God.

Here Torrance departs somewhat from his mentor Barth. He is unwilling to say that natural theology can provide information about God, yet he is also unwilling to say that it is capable of giving us anything more than very minimal information. He goes on to say that since the structures of space and time were created by God, that he is not part of creation, and hence is not bound by the laws which govern the natural world. From this point onwards Torrance becomes more and more theological, and writes<sup>21</sup>:

Rather is the Incarnation to be understood as the chosen path of God's rationality in which He interacts with the world and establishes such a relation between

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<sup>15</sup>Thomas F. Torrance: *Space, Time and Resurrection*. The Handsel Press, Edinburgh, 1976.

<sup>16</sup>See Clifford M. Will: *Was Einstein Right? Putting General Relativity to the Test*. Oxford University Press, Oxford, 1988.

<sup>17</sup>*ibid.*, *passim*.

<sup>18</sup>*Confessions*, Book XI, chapters 10–14; *City of God*, Book XI, chapters 4–6.

<sup>19</sup>*Space, Time and Incarnation*, page 49.

<sup>20</sup>*ibid.*, page 59.

<sup>21</sup>*ibid.*, page 67.

creaturely being and Himself that He will not allow it to slip away from Him into futility and nothingness, but upholds and confirms it as that which He has made and come to redeem.

This statement has virtually nothing to do with a scientific understanding of the cosmos. But it indicates the general direction of Torrance's thought, linking the incarnation with redemption. He takes this further in later books.

The title of *Space, Time and Resurrection* is somewhat misleading. It is almost entirely theological, and really has only a small amount of space devoted to how the resurrection event is related to space and time. Torrance sees the resurrection as just one item in a great sequence. This is evident from the last half of the book, the four chapters in this part being entitled "The Ascension of Christ", "The Nature of the Ascension Event", "The Ascension and the *Parousia* of Christ", and "The Lord of Space and Time". Thus only a few passages from chapter 4, "The Nature of the Resurrection Event", will be noted here.

Early in the chapter he writes<sup>22</sup>:

Unless the atonement through the resurrection breaks into, and is real in, our historical and physical existence and continues to be valid as saving in our earthly and temporal being, it is ultimately a mockery. . . . It is for this reason that eschatology, with the heart taken out of it in the denial of a genuine resurrection, is meaningless, and without relevance to the on-going life of the world. Everything depends on the resurrection of the body, otherwise all we have is a Ghost for a Saviour.

Torrance rarely refers to the New Testament in this book, but here he doubtless had in mind Paul's words in I Corinthians 15:12–19. He then proceeded to describe the resurrection as "... something that bursts through the structures and limitations of space and time as we know them . . ." <sup>23</sup>. He sees the resurrection as not only affecting the lives of those who are in a close relationship with God, but also as involving what he refers to as the "redemption of space and time". He describes it in the words<sup>24</sup>:

The healing and restoring of our being carries with it the healing, restoring, reorganizing and transforming of the space and time in which we now live our lives in relation to one another and to God. Yet immediately we are concerned with space and time and especially with their resurrection we are in the midst of eschatology in which our thinking is stretched out beyond the ultimate ends of God's purposes in creation and redemption.

These words clearly have little to do with science of any sort. Torrance sees creation, incarnation, redemption, ascension and parousia all inextricably bound up together. The remainder of the chapter is largely concerned with interpreting the resurrection event as one in this sequence.

One theological theme which Torrance considered at some length is the contingency of the universe. He wrote a moderately lengthy article about this, in which he expressed his feelings about contingency and science in the following words<sup>25</sup>:

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<sup>22</sup> *Space, Time and Resurrection*, page 87.

<sup>23</sup> *ibid.*, page 88.

<sup>24</sup> *ibid.*, page 91.

<sup>25</sup> Thomas F. Torrance: God and the Contingent World. *Zygon*, vol. 14 (1979), pages 329–348. Page 329.

Natural science assumes the contingency as well as the orderliness of the universe. If there were no order in the universe it would not be accessible to scientific knowledge; if the universe were not characterized by contingency, the laws of nature would be derived from it immediately and necessarily through logico-deductive processes without experimental questioning of nature, which would make empirical science quite pointless.

He had considered this briefly earlier, when he was discussing Origen's attitude towards space and time. He then wrote<sup>26</sup>

This was in line with Milne's unitary theory of nature and the possibility of a purely mathematico-deductive account of the laws of nature which he shared with Eddington, but which does not appear to do justice to the contingency of nature.

The two writers he referred to were both Fellows of the Royal Society of London (though they were elected before they started their aberrant work), both Christians, and the work Torrance referred to was carried out in the 1930s and 1940s. Eddington was a Quaker, and his final opus<sup>27</sup>, published posthumously, attempted to derive values for various constants of physics (such as the fine structure constant, and the ratio of the masses of the proton and electron) by pure reasoning, without any reference to experimental data. Milne, an Anglican, did not go as far. His major claim was that two different scales for time were needed, one for dealing with light and other electromagnetic phenomena, and the other for mechanical motions, including gravitational effects<sup>28</sup>. All of their ideas are now of interest only to historians of science, since their predictions turned out to be in serious disagreement with experimental data. Torrance comments further on Milne, saying<sup>29</sup>:

Theologically it provided for Milne rational argumentation for God, but it meant the limitation of God since He is not free from a relation of necessity between His transcendent rationality and that of the material universe.

In his *Zygon* paper Torrance considered further the idea of contingency. He refers to the "rather ambivalent attitude" science has shown towards the idea of contingency. He discusses the way in which science has approached the natural world without any specific reference to God, which he terms "methodological secularism"<sup>30</sup>. But he then goes on to point out that in a large number of cases this approach, which is not necessarily opposed to religion, has been transformed into "dogmatic secularism", which commonly *is* so opposed. He insists that the intelligibility of the universe cannot be separated from its contingency, since both are necessary consequences of God's rationality. He applies this to science with the words<sup>31</sup>:

The intelligibility of the universe provides science with its confidence, but the contingency of the universe provides science with its challenge. It is this deep intertwining of contingency and intelligibility that lies behind the characteristic interdependence of experiment and theory that has marked modern science since Galileo.

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<sup>26</sup> *Space, Time and Incarnation*, page 64.

<sup>27</sup> The late Sir A.S. Eddington: *Fundamental Theory*. Cambridge University Press, Cambridge, 1948.

<sup>28</sup> E.A. Milne: *Kinematic Relativity: A Sequel to Relativity, Gravitation and World Structure*. Clarendon Press, Oxford, 1948.

<sup>29</sup> *Space, Time and Incarnation*, page 64.

<sup>30</sup> God and the Contingent World, page 335.

<sup>31</sup> *ibid.*, page 344.

In a subsequent paper<sup>32</sup>, with a somewhat misleading title, Torrance expanded on the idea of “contingence”, and attempted to relate science more closely to theological understanding. After a brief discussion of the way modern science has, to some extent, abandoned the closed causal universe of Newton, he says that theology also needs to be open to revision in the future, in the same manner that science is continually undergoing revision. He goes into some detail about the way Maxwell and Einstein unified different aspects of reality by their theories of electromagnetism and relativity, respectively. He looks forward to a time when there may be something of a unification in theological concepts, though he does not spell out which direction this may take.

As in many of his other writings, he makes frequent references to Einstein and relativity in this paper. One of these reads<sup>33</sup>:

This gave rise to the concept of the space-time metrical field in terms of which relativity theory offered an account of the universe as a whole, but which, owing to the limited speed of light, had to be regarded as temporally and spatially finite. Expressed otherwise, by predicting their own limits the equations of general relativity point to a finite origin of the universe and also to a finite end.

Torrance is somewhat off the track here. The finite speed of light is not specifically related to the finiteness (temporal, spatial, or both) or otherwise of the universe. That the speed of light is finite means only that *the part of the universe which is directly accessible to observation* is finite in extent. It is true that Einstein in his first paper on cosmology<sup>34</sup> did make the assumption that the universe was spatially finite. However this was in accord with the generally prevailing view at the time (1917) — it was not until observations were made by the 100 inch telescope at Mt Wilson in the 1920s that galaxies other than our own were definitely identified. But Einstein later abandoned this assumption. Experimental evidence is not yet sufficiently accurate to give a definite answer about whether the universe is of finite spatial extent (but unbounded in the same sense that one can travel over the surface of the earth without coming to a boundary with something which is “not-earth” on the other side of it), or whether it is infinite spatially. The majority of scientists in the field are unwilling to commit themselves one way or the other, at the present state of experimental knowledge. If it is of finite spatial extent it will eventually collapse into the “big crunch”; if it is infinite spatially it will expand indefinitely. These results are also related to Torrance’s words about “a finite end” to the universe. It is known that any object of sufficiently high density will eventually collapse<sup>35</sup>. But whether the universe is above or below the critical density is, at present, a matter of dispute among scientists, as just mentioned. Any theological statements made on the basis of either the finite spatial extent or the finite future temporal extent of the universe may well suffer the same fate as other “god-of-the-gaps” arguments.

Towards the end of the paper Torrance considered some of the scientific problems which arise in discussions about the origin of the universe. The two most successful theories in physics are quantum mechanics (more specifically, quantum electrodynamics) and general relativity. In the very early universe there was a very dense mixture of many types of elementary particles. Quantum mechanics is needed to handle the interactions of the particles;

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<sup>32</sup>Thomas F. Torrance: Realism and Openness in Scientific Inquiry. *Zygon*, vol. 23 (1988), pages 159–169.

<sup>33</sup>*ibid.*, page 162.

<sup>34</sup>Reprinted in H.A. Lorentz, A. Einstein, H. Minkowski and H. Weyl: *The Principle of Relativity: A collection of original memoirs on the special and general theory of relativity*. Dover Publications, New York, n.d. Pages 177–188. Page 184: “. . . if we assume the universe to be spatially finite . . .”

<sup>35</sup>See Hawking, S.W., and Ellis, G.F.R.: *The Large Scale Structure of Space-Time*. Cambridge University Press, Cambridge, 1973. Chapter 9.

general relativity is needed because of the very high density. But these two theories use entirely different mathematical techniques, and nobody has (yet) found a satisfactory way of amalgamating them.

This is one specific case where scientists are attacking problems right at the frontier of knowledge, and are (at least temporarily) baffled about the next step. Torrance sees this as a major blockage to the scientific process. He suggests that theology could be of assistance<sup>36</sup>:

This is to say, we must approach the baffling problems of science at the frontiers of knowledge by approaching them from the other side, from the Word of God that lies behind all the intelligibility and order of the created universe.

This seems to be a lapse, on Torrance's part, from his usual high standard of reasoning. A God-of-the-gaps has crept in, albeit in a rather subtle way. The "frontiers of knowledge" about the very early universe keep changing, with remarkable speed. Steven Weinberg wrote a popular book outlining the early history of the universe, up to the formation of helium atoms. In chapter 7, entitled "The First One-Hundredth Second", he wrote<sup>37</sup>:

For reasons that I hope to make clear, we simply do not yet know enough about the physics of the elementary particles to be able to calculate the properties of such a mélange with any confidence. Thus, our ignorance of microscopic physics stands as a veil, obscuring our view of the very beginning.

But within five years Trefil was able, in another book written for the popular audience, to discuss some of the events which happened before the first one-thousandth of a second<sup>38</sup>. This sort of very rapid change in scientific knowledge is quite common. The real solution is not, as Torrance suggests, to bring in theology at this, or any other point, to explain something which science cannot explain, or to appeal to theology when scientists are quite uncertain about how to proceed. A better approach is to suspend judgment, or, better, to engage in further scientific work. Of course the danger to theology, from this approach, is that it will be seen, to the general populace, as continually yielding ground to science, and thereby rendering itself less and less relevant in the modern world. However even in this area theology could well heed remarks made by scientists. Weinberg subsequently wrote<sup>39</sup>:

However, although we do not know that it is true, it is at least logically possible that there *was* a beginning, and that time itself has no meaning before that moment.

This scientific statement is clearly parallel to the theological ones Augustine made nearly 1600 years earlier. Torrance could well have used the convergence of scientific and theological thinking as an apologetic argument, rather than falling back on our scientific ignorance.

One of his collections of essays, already referred to above, is entitled *Transformation and Convergence*. There are two chapters in this which are particularly relevant to the dialogue between science and religion: chapter 7, "Christian Theology in the Context of Scientific Change", and chapter 8, "Newton, Einstein and Scientific Theology".

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<sup>36</sup>Realism and Openness, page 167.

<sup>37</sup>Steven Weinberg: *The First Three Minutes: A Modern View of the Origin of the Universe*. Fontana, London, 1978. Page 131.

<sup>38</sup>Trefil, James S.: *The Moment of Creation: Big Bang Physics from before the First Millisecond to the Present Universe*. Macmillan, New York, 1983.

<sup>39</sup>Weinberg, op. cit., page 144.

He uses three quotations as the basis for chapter 7: “God does not play dice”; “God does not wear his heart on his sleeve”; and “God is deep but not devious”. The first and third of these come from Einstein, with the third more usually translated “God is subtle but not malicious”. The second is apparently from F.S.C. Northrop<sup>40</sup>. His discussions under each of these headings follows much the same course as in other writings, though there are some additional fresh points made. For each of them he pays more attention to theological issues than he has previously. Thus under “God does not play dice” he refers to the order which theologians search for, in the same way that scientists search for ways of ordering natural phenomena. Under “God does not wear his heart on his sleeve” he emphasises that the theologian, like the scientist, does not have all the information laid out before him in a neat way, but must search for it, just as the scientists does.

Most of his new ideas are concentrated in the final section, where he considers what it means to say that “God is deep but not devious”. This is one of the few places in his writings where he makes some attempt to consider the problem of evil. His answer is essentially a traditional one<sup>41</sup>:

Far from interfering or conflicting with the created order of things — for that has come from God — God’s creative interaction gives it a deeper level at which it is fulfilled and thus establishes it, and wherever disorder may manifest itself there he is at work in his creating and redeeming purpose restoring it to order and goodness beyond anything it is capable of in itself.

He mentions redemption at several other places in this section. Thus his solution of the problem is essentially an eschatological one: God is not only creator, but also redeemer.

Chapter 8 was originally delivered as the Eighth Annual Keese Lecture at The University of Tennessee in April 1971. As may be expected from the title, he makes considerable use of the change in scientific thinking from Newton’s ideas about separate time and space to Einstein’s unification of them into a single continuum. He also emphasises throughout the many levels which need to be discussed. Speaking specifically about science he says<sup>42</sup>:

Thus the objective of science in every field is to discover the relations of things and events at different levels of complexity, and to develop our understanding and expression of them in such a way that their real nature becomes progressively disclosed to us.

He seems to be well aware of the never-ending quest in science for deeper understanding of the natural world. He spends some time tracing some of the developments of science, and then moves on to the theological area. He starts by comparing the two subjects<sup>43</sup>:

If the task of pure science in every field is to inquire into the relations of things and events at different levels of complexity, and to develop our understanding and representation of them in such a way that their real nature becomes progressively revealed to us, that is precisely the objective of scientific theology. Its task is to bring to view the *new and distinctive kinds of connection* that obtain in the relation of God to man within the space-time structures of the creation, and to generate, under the objective pressure of the divine self-revelation, appropriate modes and systems of thought, as open and as simple as possible, . . .

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<sup>40</sup>Torrance refers to F.S.C Northrop, *Man, Nature and God*, 1962, pages 209f.

<sup>41</sup>*Transformation and Convergence*, page 257.

<sup>42</sup>*ibid.*, page 265.

<sup>43</sup>*ibid.*, page 276. Emphasis as in the original.

It is not immediately obvious just what Torrance means by his use of the adjective “simple”. In science, Maxwell’s equations for electromagnetism and Einstein’s equations for general relativity can *all* be written down on the traditional back of a single envelope. The fundamental equation governing quantum mechanics, with just four symbols and an equality sign, will fit easily onto the back of a postage stamp! However encapsulated in any one of these equations is a whole mathematical structure. Thus the equations themselves appear deceptively simple. But unravelling the consequences of these equations has engaged the attention of many scientists for many years. In the same way, it may be possible to devise some fundamental principle which could serve as the basis for theology.

Torrance then traces some of the development of theological thinking. He discusses briefly the work of Athanasius, Anselm and Kierkegaard. He spends some time discussing Barth, before returning to his pet theme, the development of what he calls “a thoroughly scientific theology”. He looks to the future for this<sup>44</sup>:

Historical theology has never even come up with an instrument corresponding to the four-dimensional geometries of space and time which have played such an astonishing role in the advance of our scientific knowledge of the created universe. But this is the task of the future. It will be far more difficult to come up with something like this in theology than in natural science, but only if we are able to come up with it, will we finally be able to overcome the dualism we have been speaking of; . . . it will be a synthesis of new structures, hierarchically ordered in multiple levels, and infinitely open to the transcendence of the living God. That must also be the task of a thoroughly scientific theology.

He is quite correct in stating that this will be a difficult task. He seems to want to have some foundations for theology which will gain the same sort of acceptance among theologians that the basic principles of relativity have received from physicists. There is a major problem involved at this point. Anyone can, in principle, conduct an experiment to check the validity of the principles or the predictions of relativity. Within the limits of experimental error, all will obtain the same results. We clearly cannot experiment on God in the same way. But if we try to obtain data from human beings, we are up against far more personal decisions than in science. Conflicts in the scientific area are, generally, over fine points of detail, and whether small discrepancies can be attributed to errors from unidentified sources, or indicate some new phenomenon. In theology, personal decisions are made at a much more basic level, such as whether it is reasonable to consider the existence of a deity, or whether people are deluding themselves.

There is also the problem of allowing for future changes. Present ideas on the structure of space and time are a recent development. Only a century ago they were quite different. In another century they may well have changed again. Unless Torrance is prepared to have some sort of shifting foundation, any search for some basic, permanent, principles is likely to be unfruitful. Before engaging in such a search, it would be worth considering how much of Torrance’s work would need fairly drastic revision (or even abandonment) if physicists abandoned their present ideas about the unity of space and time in a single space-time continuum.

Although in his early writings Torrance showed the great debt he owed to Barth, he was, even then, aware of the usefulness of Polanyi’s work on “personal knowledge”. Fairly early in *Theological Science* he wrote<sup>45</sup>:

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<sup>44</sup>ibid., page 282.

<sup>45</sup>*Theological Science*, page 93.

Thus, for example, A. Eddington, M. Polanyi, and von Weiszäcker in their different ways, have successfully shown how the personal factor inevitably enters into scientific knowledge for the very fact of our knowing explicitly enters into what we know.

. He gives a reference to Polanyi's *Personal Knowledge* here. Later in the same work, when discussing how any knowledge about God can be obtained, he writes<sup>46</sup>:

For verification we can only cast ourselves ultimately upon the justifying grace of God, since in the last resort verification of our knowledge of God must come to us from without from God Himself.

To these Barthian words he attaches a footnote, the first sentence of which reads "To this, *mutatis mutandis*, corresponds the fact that in natural science verification requires in the last resort a personal judgement in assessment of the evidence."

As time went on his interest in, and use of, Polanyi's ideas increased. In 1975 he presented a seminar paper entitled "The Place of Michael Polanyi in the Modern Philosophy of Science"<sup>47</sup>. This was an attempt to clarify Polanyi's use of the word "personal" in reference to knowledge. A common misapprehension is that Polanyi wanted to turn away from any objective knowledge about the external world, and replace it by subjective knowledge of some sort. This would mean that different cultures, for example, could have quite different interpretations of basic sciences such as physics or chemistry. In fact, as Torrance pointed out, Polanyi was referring more to the *decisions* made by scientists than to the knowledge obtained<sup>48</sup>:

Thus the scientist is himself the ultimate judge of what he accepts as true or rejects as false, but this judgment implies a submission to standards of judgment independent of him which he freely accepts as the criteria for his own judgments. . . . Far from doing as he pleases the scientist forces himself to act as he believes he must act under the requirements of reality and its intrinsic rationality.

As may be suspected from the title, there was very little reference to theology in the paper. However right at the end he remarked<sup>49</sup> "While the knowing of God, Polanyi remarks, is outside his argument, his conception of knowing opens the way to it: natural knowing expanding continuously into knowledge of the supernatural."

In November 1978 a conference was held at St Catherine's, Cumberland Lodge, Windsor, with the theme "Belief in Science and in Christian Life: the relevance of Michael Polanyi's thought for Christian Faith and Life". The addresses at the conference were expanded, and Torrance edited the ensuing volume of papers<sup>50</sup>. An extremely useful part of the volume is a section entitled "Notes on Terms and Concepts"<sup>51</sup>, written by Torrance himself. The note on "personal knowledge" occupies half a page, of which the last two sentences are:

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<sup>46</sup>ibid., page 197.

<sup>47</sup>Reprinted as chapter 3 in *Transformation and Convergence*.

<sup>48</sup>ibid., p.155.

<sup>49</sup>ibid., page 160.

<sup>50</sup>Thomas F. Torrance (ed.): *Belief in Science and in Christian Life: The Relevance of Michael Polanyi's Thought for Christian Faith and Life*. The Handsel Press, Edinburgh, 1980. Referred to subsequently as *Belief in Science*.

<sup>51</sup>ibid., pages 133–147.

Personal knowledge is a way of knowing through responsible commitment to the claims of reality in which the personal and the objective are fused together in the act of establishing contact with reality and its intrinsic rationality. In personal knowledge responsibility and truth are two complementary aspects of commitment to reality: the act of judgment is the personal pole and the independent reality on which it bears is its external pole.

This is a concise, yet quite clear, definition of what Polanyi discussed at greater length. It brings out both the personal nature of any decisions involved, and also the external reality about which decisions are to be made.

Despite the title of the book, most of the chapters in it refer far more to religion than to science. Only the first chapter, entitled “The Framework of Belief”, by Torrance, contains a significant amount of consideration of science. In the introductory part he considers the nature of beliefs in general, before engaging in specific discussions of beliefs in either scientific or theological realms. He considers Clement of Alexandria and Augustine as typical examples of the school of patristic thought which attempted to relate religious faith to our perceptions of the external world. He mentions the way their Aristotelian ideas were replaced, during and immediately after the Reformation period, by purely mechanistic ideas about the cosmos. Then, after referring to Einstein’s ideas again, he brings in the way personal decisions are made about interpreting the natural world<sup>52</sup>:

Beliefs are certainly personal acts, as we shall see, for it is only persons who are capable of engaging in objective operations, in which they refer meaningfully away from themselves and distinguish orderly patterns and structures as having reality independent of their perceptions.

He then rapidly moves on to consideration of some specific beliefs<sup>53</sup>:

There are, of course, significant differences between religious beliefs and scientific beliefs, but the differences have to do, not with their status as beliefs, so much as with the nature of that in which we believe and in the kind of intelligibility inherent in what we believe.

Having introduced the external reality which is the object of belief, he proceeds to describe the way belief is, in some sense, forced upon the believer<sup>54</sup>:

Rather does belief arise in us, as we have seen, because it is thrust upon us by the nature of the reality with which we are in experiential contact. It arises as we allow our minds to fall under the compelling power of an intelligible structure or order inherent in the nature of things which we cannot rationally or in good conscience resist.

The remainder of the essay is largely devoted to the development of various forms of belief in the human mind. Torrance concentrates on the way “we allow our minds” to make decisions about what we observe. This is the real essence of “personal knowledge” — it is a decision which must be taken separately by each individual person.

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<sup>52</sup>ibid., page 12.

<sup>53</sup>ibid.

<sup>54</sup>ibid., page 13.

Another collection of essays by Torrance is entitled *The Christian Frame of Mind*<sup>55</sup>. Several chapters in this are of interest. Chapter 2 is entitled “The Concept of Order in Theology and Science”; chapter 4 “Theological and Scientific Inquiry”; and chapter 5 “Fundamental Issues in Theology and Science”. There is little fresh material in these chapters. Chapter 2 repeats the idea of order arising because the cosmos was created by a rational God; chapters 4 and 5 concentrate on the contingency, as well as the order, of the natural world. In chapter 5 he gives some attention to the idea of “meaning” in the universe. Here again there is a slight suggestion of a God-of-the-gaps approach, for he writes<sup>56</sup>:

If scientists looking for meaning at the frontiers of knowledge are to reckon seriously with an open-ended semantic focus of this kind in the universe, should they not cultivate the habit of listening for and recognising the Voice of the Creator?

Torrance here seems to be using the word “meaning” in a slightly different sense to that of the scientists he is criticising. He has a more fundamental concept in mind, the fundamental meaning of the universe; scientists use it with a less deep sense — “What does this particular observation mean?”

One notable absence from Torrance’s writings is any significant mention of miracles. Even though two of his books, *Space, Time and Incarnation* and *Space, Time and Resurrection* deal with two of the fundamental miracles associated with the Christian faith, the first does not mention the miraculous nature of the incarnation, and the second makes only passing references to miracles. There is a very brief paragraph in *Theological Science* where he mentions Polanyi’s comment that an experimental verification of *any* miracles would *disprove* their miraculous nature<sup>57</sup>. He refers to this again on page 22 of *Space, Time and Resurrection*. Apart from this, his only reference to miracle in this book occurs in chapter 4, “The Nature of the Resurrection Event”, where he writes on page 94:

Here, however, we have to reckon with the nature of the subject in the incarnation and in the resurrection, for, as we have seen, the resurrection is to be understood in consistency with Jesus Christ himself, who is the person who rose from the dead. . . . This is why we can speak of the whole historical Jesus from birth to resurrection as sheer miracle or downright *resurrection* from beginning to end.

This, of course, is not the usual usage of the word “miracle”. This neglect of miracles is a grave defect of his work. Other writers, scientists such as Polkinghorne discussed above, and amateur theologians like C.S. Lewis<sup>58</sup>, have realised the necessity of giving some attention to the miraculous if religion is not to be completely ignored in modern technological society, where cause and effect are assumed to reign supreme, and miracles simply do not occur. It is somewhat surprising that Torrance has not seen the need to do likewise.

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<sup>55</sup>Thomas F. Torrance: *The Christian Frame of Mind: Reason, Order, and Openness in Theology and Natural Science*. Helmers & Howard, Colorado Springs, 1989. Enlarged edition. Originally published in 1985.

<sup>56</sup>*ibid.*, p.98.

<sup>57</sup>*Theological Science*, pages 299f. The reference is to Polanyi’s *Personal Knowledge*, page 284: “. . . if the conversion of water into wine or the resuscitation of the dead could be experimentally verified, this would strictly disprove their miraculous nature. Indeed, to the extent to which any event can be established in the terms of natural science, it belongs to the natural order of things. However monstrous and surprising it may be, once it has been fully established as an observable fact, the event ceases to be regarded as supernatural. . . . Observation may supply us with rich clues for our belief in God, but any scientifically convinced observation of God would turn religious worship into an idolatrous adoration of a mere object, or natural person.”

<sup>58</sup>C.S. Lewis: *Miracles: A Preliminary Study*. Geoffrey Bles. London, 1947.

From the evidence presented here it is possible to draw some conclusions about how Torrance sees the relationship between science and theology in the modern world, and how dialogue between them can most profitably be carried on. His main argument revolves around the contingency and rationality of the universe. He attributes this to its creation by a rational God, and suggests that theology should adopt a rational approach to its subject, akin to, but different from, the rational approach adopted by science. He also emphasises the personal nature of decisions which are made within the scientific and theological areas. He is careful here to state that in both these realms any decisions are not subjective (in the more usual sense of the word) but are controlled to a great extent by the objective reality with which they are dealing.

He writes very little about the major points of conflict which have arisen in the past, and continue to be discussed. He says, quite strongly, that any branch of study which claims to be the only way of obtaining “ultimate” truth is misguided<sup>59</sup>:

As we have seen, by its doctrine of God and creation theology acknowledges the full place of the other sciences as independent branches of the knowledge of contingent realities, but whenever these special sciences seek to unify and extend their knowledge of contingent processes beyond the boundary of what is creaturely, contingent and relative, claiming to be the one and only way of penetrating into the ultimate secrets of the universe, or at least of being able to test theological knowledge for its truth or falsity, then theology cannot but come into conflict with them.

But just as any advance in science is likely to raise more questions than it answers, this statement raises further problems. How we can determine “the boundary of what is creaturely, contingent and relative”? Who determines this boundary — scientists or theologians? Is it to be some sort of joint effort?

Torrance is quite right to reject scientism as a philosophical approach to ultimate questions. But theology also needs a measure of humility in this area. There is scope here for much further study.

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<sup>59</sup> *Theological Science*, page 283.

# Chapter 6

## Some Other Writers

If there existed a superior being who possessed the supernatural qualities of omniscience, omnipotence, immortality, and incomprehensibility, how would he/she act differently from us, and would these differences be knowable?

Steven J. Brams<sup>1</sup>

In this section some other works on the science/religion dialogue will be briefly mentioned. Discussion will be limited by restricting it to works published during the ten year period 1980–1989. None of the vast amount of literature on the modern creationist issue will be mentioned, since relatively little has been written about this from a theological perspective. To give an overview of these writings, one or two works on each of a number of distinct areas will be mentioned, with a brief comment on each.

A number of conferences on the relationship between science and religion were held during this period, with quite different themes.

The World Council of Churches held a conference with the title “Faith, Science and the Future” in 1979, and the papers and proceedings were published in 1980<sup>2</sup>. A number of the papers presented criticised Western nations for diverting scientific efforts towards military purposes, rather than towards alleviating human suffering.

Revised versions of papers presented at a symposium held in Oxford in 1979 were published in 1981<sup>3</sup>. One of the sections was devoted to epistemological issues, and there was considerable emphasis on the notion of personal knowledge.

To commemorate the centenary of the birth of William Temple a conference was held in Toronto in August 1981. The proceedings were published in 1983<sup>4</sup>. The papers examine some aspects of Temple’s thought, and look at the area on the frontiers (or overlap) between science and religion.

A conference was organised in 1982 to mark the centenary of the death of Charles Darwin. The papers presented there, with some additional ones, were published in 1985<sup>5</sup>. The papers

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<sup>1</sup>Steven J. Brams: *Superior Beings: If They Exist, How Would We Know? Game-Theoretic Implications of Omniscience, Omnipotence, Immortality and Incomprehensibility*. Springer-Verlag, New York, 1983. Page vii.

<sup>2</sup>Roger L. Shinn and Paul Abrecht, (eds.): *Faith and Science in an Unjust World: Report of the World Council of Churches’ Conference on Faith, Science and the Future*. World Council of Churches, Geneva, 1980.

<sup>3</sup>A.R. Peacocke, (ed.): *The Sciences and Theology in the Twentieth Century*. Oriel Press, Stocksfield, Northumberland, 1981.

<sup>4</sup>F. Kenneth Hare, (ed.): *The Experiment of Life: Science and Religion*. University of Toronto Press, Toronto, 1983.

<sup>5</sup>John Durant, (ed.): *Darwinism and Divinity: Essays on Evolution and Religious Belief*. Basil Blackwell, Oxford, 1985.

concentrated on the implications the acceptance of the idea of evolution has for religious belief.

In 1981 a conference was held on the historical relations of Christianity and science, and the proceedings were published in 1986<sup>6</sup>. It was organised by historians, mainly to present evidence that the “warfare” idea of the relationship between science and religion is a misrepresentation of the case. The papers covered the whole period from the early church to the twentieth century.

One of the more significant events in the period is the publication of the series edited by Torrance, under the title *Theology and Science at the Frontiers of Knowledge*. The first volume, by Torrance himself<sup>7</sup> was published in 1985, and the series has now reached 12 volumes, each of which is devoted to a relatively restricted topic. The authors are from a wide range of theological viewpoints, and from different areas of science. As yet, none specifically considers methodological issues.

The writings of various individuals, philosophers, scientists and theologians, over this period cover the full range of categories put forward by Proudfoot (see page 2 above), so that we are not yet at the stage of an agreed approach, though there are hopeful signs of unity.

An interesting application of the methods of science to religious ideas has been made by Steven Brams, Professor of Politics at New York University. He has applied the mathematical theory of games in two different areas. His first book<sup>8</sup> applied it to some of the stories in the Old Testament, treating these as records of conflict between two opponents, either two human beings or a human being and God. On page 5, in the introduction, he writes, “Since God does not always get His way, He can properly be viewed as a participant, or *player*, in a game”. The second book<sup>9</sup>, from which the quotation at the head of this chapter was taken, attempted to analyse various attributes of deity in terms of particular games played between two people. This work clearly falls within Proudfoot’s category 3 (see page 2 above), though it seems very doubtful that William James had in mind such a detailed application to religious ideas of a specific mathematical technique.

On the philosophical side, Richard Swinburne’s trilogy *The Coherence of Theism* (1977), *The Existence of God* (1979) and *Faith and Reason* (1981) are well known. These do not contain a great deal of discussion about how science relates to religion. He took up the issue in more detail in his Gifford Lectures at Aberdeen in 1983–1984<sup>10</sup>. The title of the book is somewhat misleading, since the bulk of it deals with the mind-body problem. He expresses his viewpoint in the introduction in these words<sup>11</sup>:

The body is an ordinary material object, and so is that crucial part of it — the brain; but the latter is connected to a soul which is the essential part of a man, and which is the part which enjoys the mental life (i.e. which is the subject of sensation and thought and the originator of actions). The evolution of consciousness is the evolution of organisms with souls which are conscious and which interact with the body.

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<sup>6</sup>David C. Lindberg and Ronald Numbers, (eds.): *God and Nature: Historical Essays on the Encounter Between Christianity and Science*. University of California Press, Berkeley and Los Angeles, 1986.

<sup>7</sup>Thomas F. Torrance: *Reality and Scientific Theology*. Scottish Academic Press, Edinburgh, 1985.

<sup>8</sup>Steven J. Brams: *Biblical Games: A Strategic Analysis of Stories in the Old Testament*. The MIT Press, Cambridge, Massachusetts, 1980.

<sup>9</sup>Steven J. Brams: *Superior Beings: If They Exist, How Would We Know? Game-Theoretic Implications of Omniscience, Omnipotence, Immortality and Incomprehensibility*. Springer-Verlag, New York, 1983.

<sup>10</sup>Richard Swinburne: *The Evolution of the Soul*. Clarendon Press, Oxford, 1986.

<sup>11</sup>*ibid.*, page 2.

The final chapter in the book is entitled “The Future of the Soul”. In this he considers what happens when the body dies and the brain ceases to function. The last paragraph in the chapter contains the sentences<sup>12</sup>:

Humans can move light bulbs and put them into entirely different sockets. But no human knows how to move a soul from one body and plug it into another; nor does any known natural force do this. Yet the task is one involving no contradiction and an omnipotent God could achieve it; or maybe there are other processes which will do so. And just as light bulbs do not have to be plugged into sockets in order to shine (loose wires can be attached to them), maybe there are other ways of getting souls to function than by plugging them into brains.

In an appendix he suggests that these ideas are compatible with the Christian doctrine of the resurrection of the body. The ideas expressed in the book seem to be related to both of Proudfoot’s categories 4 and 6.

One area in science which has attracted some attention from the religious community is that which has been labelled “The Anthropic Principle”. The most extensive treatise on this<sup>13</sup>, describes the principle in the following words:

This book was begun long ago. Over many years there had grown up a collection of largely unpublished results revealing a series of mysterious coincidences between the numerical values of the fundamental constants of nature. The possibility of our own existence seems to hinge precariously upon these coincidences.

This book is highly technical in many places, but presents most of what is regarded as evidence for the “design” of the universe. It only mentions religious topics in passing. An earlier popular book on the subject by Paul Davies<sup>14</sup> concludes with the words:

It is my deep conviction that only by understanding the world in all its many aspects — reductionist and holist, mathematical and poetical, through forces, fields, and particles as well as through good and evil — that we will come to understand ourselves and the meaning behind this universe, our home.

This book seems to straddle Proudfoots categories 4 and 6.

An increasing number of scientists are writing books which include mention of their personal religious beliefs. One by Stannard includes in the introductory chapter the words<sup>15</sup>:

What I hope to show is that the alleged controversies of the past were not what they are now widely thought to have been; the very latest revelations of science, instead of posing fresh difficulties, have led to new harmony; and the methods of investigation used in science and religion, far from being opposed to each other in their outlook, are in many ways similar. Indeed, before we have finished, you might well think it easier for me, as a scientist, to believe in God than it is for you!

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<sup>12</sup>ibid., pages 310f.

<sup>13</sup>John D. Barrow and Frank J. Tipler: *The Anthropic Cosmological Principle*. Clarendon Press, Oxford, 1986.

<sup>14</sup>Paul Davies: *God and the New Physics*. Penguin Books, Harmondsworth, Middlesex, 1984.

<sup>15</sup>Russell Stannard: *Science and the Renewal of Belief*. SCM Press, London, 1982. Page 2.

The final chapter of the book by Brown<sup>16</sup> is entitled “The Religious Dimension of Science”. The last section in this deals with the distinction between scientific and religious ways of thinking, and criticises modern creationism for failing to make this distinction. The last chapter in the book falls, generally, within Proudfoot’s category 6.

From the biological side Alister Hardy has written a book<sup>17</sup> which gives a survey of the nature of evolution, and the evidence in favour of it. He then discusses the phenomenon of faith, and some of the data collected by the Religious Experience Research Unit at Oxford. He concludes that traditional Darwinism is incomplete, since it ignores this evidence of the spiritual side of mankind. This book is one of those which is not easily classified. Different parts of it fall in Proudfoot’s categories 3, 4, 5 or 6.

Process theology relies heavily on evolution. The book by Birch and Cobb<sup>18</sup> takes this to rather an extreme. The authors come close to placing all forms of life on an equal footing. They commonly write Life, with a capital letter, indicating something of the importance they attach to all living organisms. In the section entitled “Life as God” they write<sup>19</sup>

Life is purposeful. Indeed, it is defined by its purpose. It is not the sheer blind ‘ongoingness’ of things, but the cosmic aim for value. . . . Life does not aim specifically at the creation of human beings. It has no one goal for the course of evolution on our planet. There is no plan for the future written into Life which it is our task to discern. Life aims at the realisation of value, that is rich experience or aliveness. In some measure it realises value in every living thing. But it aims beyond the realisation of trivial value for the realisation of richer experience. To this end it produces creatures in profligate abundance so that through the process of selection some will emerge with greater intelligence and capacity for feeling. Life has achieved rich value in dolphins as well as in human beings. We cannot guess the forms it may have achieved on other worlds.

This emphasis on value might seem to place it, at least partly, within Proudfoot’s category 4. However the way in which religious thinking is subordinated to scientific findings has much more in common with his category 2. The elevation of “Life” to some sort of cosmic principle goes far beyond what most Christian thinkers, even those who support process theology, would be happy to accept. It seems to be more allied to Buddhism than Christianity.

As mentioned earlier, not all writings about science and religion fit neatly into one of the categories defined by Proudfoot. One (theological) example of this is Jürgen Moltmann. In his work on anthropology from a Christian perspective<sup>20</sup> he made considerable use of information derived from secular anthropologists. However in his discussion of creation<sup>21</sup>, which forms the second volume in his series on systematic theology, he paid virtually no attention to scientific data about the universe as a whole (and was severely criticised by Polkinghorne for this omission). He did make some use of information on ecology, but this was only to a quite minor extent. In the introductory chapter he wrote<sup>22</sup>:

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<sup>16</sup>Hanbury Brown: *The Wisdom of Science: its relevance to Culture and Religion*. Cambridge University Press, Cambridge, 1986.

<sup>17</sup>Alister Hardy: *Darwin and the Spirit of Man*. Collins, London, 1984.

<sup>18</sup>Charles Birch and John Cobb: *The Liberation of Life: From the Cell to the Community*. Cambridge University Press, Cambridge, 1981.

<sup>19</sup>ibid., page 197.

<sup>20</sup>Jürgen Moltmann: *Man: Christian Anthropology in the Conflicts of the Present*. SPCK, London, 1974.

<sup>21</sup>Jürgen Moltmann: *God in Creation: An Ecological Doctrine of Creation*. SCM Press, London, 1985. The Gifford Lectures at St Andrews, 1984–1985.

<sup>22</sup>ibid., page 22.

We shall not, therefore, choose the way out taken by the “creationists”, who want to confront the present day, and the modern natural sciences and their theories, with the alternative of a biblicist cosmology. That would be nothing but a retreat to the doctrine of creation of a past era. It would not be an interpretation of the belief in creation today, in the light of its true origins.

On the other hand, we are also unable to follow those theologians who accept the cosmological theories that are under discussion at the moment, sanctioning them by making them the basis of their own religious cosmologies. That would be to merely be to dissolve the specifically Jewish and Christian belief in creation in a generally religious elevation of a world view which happens to be the subject of debate at the present time.

Here we shall take a different approach, and shall pursue the model of identity and relevance. The *identity* of the Christian belief in creation has become questionable in today's ecological crisis and must therefore be given a new definition in that context; while the *relevance* of belief in creation must prove itself in ideas about the present ecological crisis and in suggested ways of escape from that crisis.

Moltmann thus rejects Proudfoot's categories 1 and 2 as possible options for modern theology. He seems to want to opt for category 4, with his reference to “relevance”. But since he makes so little reference to, or use of, scientific findings the work, in practice, is much closer to category 5. He does not go as far as Barth in denying that science can have anything to say to the theologian, but he seems to ignore much of what could be useful to him.

The Bishop of Birmingham has produced a work<sup>23</sup> which attempts to show that the existence of God, rather than a sequence of “random” occurrences, is more probable as a satisfactory explanation of the complexities of the material world. It falls mostly within Proudfoot's category 6. It is uneven in character, and is marred, in part, by the somewhat excessive reliance the author places on the work of people like James Lovelock<sup>24</sup>, who is regarded as being on the extreme fringe of the scientific community, and Rupert Sheldrake<sup>25</sup>, whose work is regarded, by virtually all scientists, as completely without foundation.

The zoologist David Hay has written a book<sup>26</sup> emphasising the personal aspects of religious experience, and hence religious knowledge. The concluding sentences in the book are<sup>27</sup>:

People who become religiously aware seem to experience *directly* their solidarity with their fellow-men and their responsibility towards them. Tasks which had previously appeared impossible begin to look less formidable. They are less inclined to be seduced into the amassing of goods, because they perceive that there are other sources of security. Life gains meaning. These would appear to be advantages of our biological heritage not to be lightly ignored.

The book lies mostly within Proudfoot's category 4, though it is also related to category 6.

Lesslie Newbigin has written a short book<sup>28</sup> whose theme is the way religion has been

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<sup>23</sup>Hugh Montefiore: *The Probability of God*. SCM Press, London, 1985.

<sup>24</sup>James Lovelock: *Gaia: A New Look at Life on Earth*. Oxford University Press, Oxford, 1982.

<sup>25</sup>Rupert Sheldrake: *A New Science of Life: The Hypothesis of Formative Causation*. New edition with an appendix of comments, controversies and discussions provoked by the first edition. Anthony Blond, London, 1985. Originally published 1981.

<sup>26</sup>David Hay: *Exploring Inner Space: Scientists and Religious Experience*. Penguin Books, Harmondsworth, Middlesex, 1982.

<sup>27</sup>*ibid.*, page 213.

<sup>28</sup>Lesslie Newbigin: *Foolishness to the Greeks: The Gospel and Western Culture*. SPCK, London, 1986.

relegated to the private world of values. Chapter 4 is entitled “What can we know? The Dialogue with Science”, and is the longest in the book. He rejects Proudfoot’s category 4 in the following words<sup>29</sup>

To be specific, the currently popular way of coping with the science-religion debate by regarding it as an example of two ways of “seeing as” is, I fear, only a particular manifestation of that dichotomy between the public world of facts and the private world of values about which I have spoken. . . . if we are talking as the Bible talks about God, who is Creator and Governor of all things, who acts in specific ways, and whose purpose is the criterion for everything human, whether in the public or the private sectors, then there is inevitable conflict. . . . For there can be no question that for the ordinary educated person in our society, the real world is not the world of the Bible but a world that can be explained, and is being more and more fully explained, without reference to the hypothesis of God.

Later he discusses the rise of modern science, and refers to Jaki’s two major works. He then writes<sup>30</sup>

For to put it briefly, if the world is not rational, science is not possible; if the world is not contingent, science is not necessary. . . . Without that passionate faith in the ultimate rationality of the world, science would falter, stagnate, and die — as has happened before. . . .

But — and this is the other equally important fact — faith in the rationality of the universe would not sustain science without the concurrent belief that the universe is not necessary being but contingent being.

With his emphasis on contingency and rationality his work is quite close to that of Jaki, Polkinghorne and Torrance. There are very faint traces throughout Newbigin of Proudfoot’s category 1. However they are very faint indeed, and overall his work is best classified in Proudfoot’s category 6.

As the final item considered in this section, the eminent theologian Wolfhart Pannenberg has responded to some other writers<sup>31</sup> in an issue of *Zygon* devoted to a discussion of some aspects of his work. His main theme is the way God interacts with the world, and he expresses his viewpoint in the following words<sup>32</sup>:

My specific way of dealing with the theological task of interpreting reality in terms of God’s action is characterized, as Hefner presents it, by the notions of contingency and field. . . . While this temporal interpretation of the field concept allows us to conceive of contingency as a manifestation of such a field, I am well aware that this is no longer the field concept of classical electrodynamics and gravitational theory. But it should not be considered illegitimate (as in Wicken 1988) to use a scientific concept in a new way as long as the reshaping is deliberate (does not simply emerge as accidental equivocity) . . .

Rather than speaking of using “a scientific concept in a new way” it would be much more correct to say that Pannenberg is taking a word, which has a precise meaning in a scientific

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<sup>29</sup>ibid., page 67.

<sup>30</sup>ibid., pages 70f.

<sup>31</sup>Wolfhart Pannenberg: Theological Appropriation of Scientific Understandings: Response to Hefner, Wicken, Eaves, and Tipler. *Zygon*, vol. 24 (1989), pp. 255–271.

<sup>32</sup>ibid., page 256.

context, and using it to mean something different in a religious context. This is not just an oversight on his part, since he subsequently writes<sup>33</sup>:

We can appropriate the language of self-organizing systems (exploiting the thermodynamic flow of energy degradation) for interpreting organic life as a creation of the Spirit of God.

Pannenberg seems here to be making the same sort of error which was made in the 19th century, when evolution was taken over from biology into religion, history, and so on, with little justification, and in the 1920s when relativity was taken from physics and the catch-cry became "Everything is relative". Pannenberg's "field" has little in common with the various fields in mathematical physics other than the name. Overall, in this paper, he seems to lie somewhere between Proudfoot's categories 4 and 6.

From the brief discussion here of recent writing it is again clear that methodological and epistemological issues have not received a great deal of attention during the past decade. Apart from the collection of essays edited by Peacocke none of the writers mentioned have included any significant discussion of how matters such as rationality and contingency should be involved when it comes to the treatment of specific issues in the science-religion dialogue. While there is no unanimity of approach among these recent writers, they are much closer to each other than the writers of earlier times. There seems to be a gradual move towards acceptance of Proudfoot's category 6 as the best option for dialogue between science and religion.

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<sup>33</sup>ibid., page 260.

# Chapter 7

## Conclusion

No matter how far the boundaries are pushed back, there will always be room both for religious faith and a religious interpretation of the physical world.

For myself, I feel much more comfortable with the concept of a God who is clever enough to devise the laws of physics that make the existence of our marvellous universe inevitable than I do with the old-fashioned God who had to make it all, laboriously, piece by piece.

James S. Trefil<sup>1</sup>

Towards the end of his life Augustine sat down and went through his writings. He made various comments about them in the light of further study he had made. When he came to consider *The Literal Meaning of Genesis* he wrote<sup>2</sup>:

In this work, many questions have been asked rather than solved, and of those which have been solved, fewer have been answered conclusively. Moreover, others have been proposed in such a way as to require further investigation.

The same feelings have been expressed by almost all those who have written about the interactions between science and religion. The three writers whose works have been discussed in this essay are no exception.

A number of similarities have been shown between the thoughts of Jaki, Polkinghorne and Torrance. The most significant is their emphasis on the contingency and rationality of the universe. This has almost always been strongly stressed in traditional Christian theology, so it is not very surprising that they should agree about it. Their approaches all fall (mostly) within Proudfoot's category 6, which again is not too surprising. There is also the matter of "personal knowledge". They have each emphasised its importance in the theological realm, and have included it, but not with equal degrees of emphasis, for scientific knowledge.

One scientific result, not mentioned above, which they have all referred to in their writings (though quite briefly) is the work of Kurt Gödel on the incompleteness of logical systems<sup>3</sup>. This is an area which has been greatly neglected by theologians, probably due to the lack of advanced training in mathematics (among theologians) which is needed to appreciate some of the subtleties of Gödel's reasoning.

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<sup>1</sup>James S. Trefil: *The Moment of Creation — Big Bang Physics from before the First Millisecond to the Present Universe*. Macmillan, New York, 1983. Page 223.

<sup>2</sup>Saint Augustine: *The Retractions*, II.50. Translated by Sister Mary Inez Bogan. The Catholic University of America Press, Washington, 1968. Page 169.

<sup>3</sup>See, for example; Jaki, *The Road of Science*, page 253; Polkinghorne, *One World*, page 25; Torrance, *Transformation and Convergence*, pages 136–145.

There are some topics which two of the three treat at some depth, but the remaining one virtually ignores. Thus Jaki and Torrance emphasise the way modern science arose in Christian Europe. Polkinghorne has little to say on this. On the other hand, Polkinghorne and Torrance emphasise the role personal knowledge plays in the development of science. Jaki does not pay great heed to this, even though his major works deal with this development throughout history. Polkinghorne and Torrance also emphasise the need to consider many levels of description: they both discuss this in science, but only Polkinghorne makes significant mention of it in connection with theology. Jaki has little to say about the need to discuss different levels of description, in either science or theology.

But there are also significant differences between them. As mentioned earlier, Jaki has perhaps over-emphasised the way science came to life in Christian Europe. If there is a distinctive point about Torrance's voluminous writings it is his continual reference to, and use of, the unification of space and time brought about by Einstein's ideas. Only Polkinghorne has emphasised that both science and religion provide data: science mostly in a rather impersonal, objective manner, and religion in a more personal way. However he states quite firmly that all the data, from whatever source it comes, must be held on to and considered as valid, whatever problems, philosophical, theological or scientific, may arise in trying to relate the two sets of data. He is thus in line with Habgood's happy phrase "uneasy truce".

Of the three only Polkinghorne has attempted to face up to the details of the real problems at the interface between science and religion — how can a deterministic universe, in which cause and effect hold sway, have any room for intervention by a deity? This is a major problem faced by theology in the modern world, rivalled perhaps only by the problem of evil. Polkinghorne has not provided a completely satisfactory answer, but his ideas are at least a starting point for further work.

One rather surprising fact which has emerged from this study is that none of the three are completely free from some types of reasoning which involves god-of-the-gaps. It seems that this very old argument can insert itself in rather subtle ways.

The idea of personal knowledge, at least in theology, is not new. Over half a century ago the then Archbishop of York, William Temple, delivered the Gifford Lectures at Glasgow. One point he took up was the personal nature of religion, and the way revelation cannot be separated from what goes on in the physical world. He summarised his views in the following words<sup>4</sup>:

If there is no ultimate Reality, which is the ground of all else, then there is no God to be revealed; if that Reality is not personal, there can be no special revelation, but only uniform procedure; if there be an ultimate reality, and this is personal, then all existence is revelation. Either all occurrences are in some degree revelation of God, or else there is no such revelation at all; for the conditions of the possibility of any revelation require that there should be nothing which is not revelation. Only if God is revealed in the rising of the sun in the sky can He be revealed in the rising of a son of man from the dead; only if He is revealed in the history of Syrians and Philistines can He be revealed in the history of Israel; only if he [sic] chooses all men for His own can He choose any at all; only if nothing is profane can anything be sacred.

We can see in these words a small glimpse of what Polanyi was later to spell out in more detail.

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<sup>4</sup>William Temple: *Nature, Man and God*. Macmillan and Co., London, 1934. Page 306.

A useful analogy for personal knowledge has been given by Lesslie Newbigin<sup>5</sup>.

A very large part of our knowledge is tacit and cannot be communicated by specifying precise details. I can immediately recognize my wife in a crowd of a thousand people, but I could not give a description of her that would enable anyone else to do so. In this sense I know a great deal more than I can put into words. There are millions of human beings whose faces are basically formed in the same way and with the same colour, but I could never confuse one of these with my wife. Yet I could not account for this fact by the most detailed measurements of her nose, chin, forehead, and so forth.

This difficulty about communicating any aspect of “personal” or “tacit” knowledge could help to explain the rather unsatisfactory nature of some of the recent writing on the topic of science and religion. The various authors may well have had some deep personal knowledge, but failed to communicate it adequately.

This essay has concentrated on what might be best termed “academic” approaches to the interaction between science and religion. In the popular mind things may well be quite different. Most of the general community would probably have a belief somewhat akin to Proudfoot’s category 2, that religion should take the findings of science and use these as some sort of basis. There would also be a few who would hold to his category 1, that religion should be supreme and that all other areas of learning should be subservient to it. The extreme fundamentalist wing typifies this strand of thought. There would be an even smaller group who would want to hold to one of Proudfoot’s other categories.

The three writers considered in detail here are all well within Proudfoot’s category 6. But perhaps at this point, in concluding, it is worth looking at some further quotations from them, to see how far each of them lean towards Proudfoot’s categories 1 and 2.

Dealing with Torrance first, he seems to have a slight bias, but only a slight one, towards category 1, and seems occasionally to prefer the findings of theology above those of science. Thus he writes<sup>6</sup>

But since it is the contingency of the realities of the empirical universe upon God that gives them their intelligibility and enables us to grasp their natural and inherent structures, genuine interaction between theological science and natural science cannot but be helpful to both. In this respect the doctrine of the creation of the universe out of nothing can be of special importance for natural science, . . . That is why a closer dialogue between natural science and theological science may help scientists to remain rigorously faithful to the contingent nature of the universe and its intelligibility in the face of the temptations I have been discussing.

It is certainly true that closer dialogue between scientists and others, not just theologians, is needed. However whether this would “help scientists to remain rigorously faithful to the contingent nature of the universe” is rather a moot point. There are a negligible number of scientists who have attempted, in recent years, to follow the lead of Eddington or Milne and try deriving results without reference to the natural world. There are, of course, many who are trying to derive fundamental theories which would unite all aspects of physics under one great principle. But this is another matter. It is much more closely allied to the intelligibility of the universe.

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<sup>5</sup>Lesslie Newbigin: *Foolishness to the Greeks: The Gospel and Western Culture*. SPCK, London, 1986. Page 80.

<sup>6</sup>Torrance, *God and the Contingent World*, pages 346f.

But any such dialogue would also be of great help to theologians. It may keep them on their toes. If they realise more of the transient nature of much scientific theorising they may see less need for continuing attempts at producing a unified view of the cosmos.

Polkinghorne, on the other hand, seems to believe that what theologians can learn from science is more significant than what scientists can learn from theology. Thus he writes<sup>7</sup>:

The remarkable insights that science affords us into the intelligible workings of the world cry out for an explanation more profound than that which it itself can provide. Religion, if it is to take seriously its claim that the world is the creation of God, must be humble enough to learn from science what the world is actually like. The dialogue between them can only be mutually enriching. The scientist will find in theology a unifying principle more fundamental than the grandest unified field theory. The theologian will encounter in science's account of the pattern and structure of the physical world a reality which calls forth his admiration and wonder. Together they can say with the psalmist:

O Lord how manifold are thy works!

In wisdom thou hast made them all.

(Psalm 104:24)

Of course, any reading of the Psalms leads inevitably to consideration of what "personal knowledge" the writer had, which he is trying to communicate. Polkinghorne places a high value on this.

When we turn to Jaki, we find that he has taken a middle way, attempting to place science and theology on an equal footing<sup>8</sup>:

Of course, the scientist's evidence of the simplicity and orderliness of nature is much more extensive than that available to the ordinary layman. Yet, even the scientist's glimpse of that orderliness is far from being exhaustive. The condition of the scientist is therefore much the same as that of the man of religion. Religious faith, like the faith of the scientist, has its set of evidences. Religious faith is not a blind faith. Yet, numerous as its evidences might be, they do not form a complete, exhaustive set. Those evidences, like the evidences of science, are rather a prompting towards espousing propositions that imply unconditional affirmation and absolute commitment. It is through commitment that the man of science grasps the simplicity and order of nature, and it is through a similar commitment that the man of religion grasps the spiritual and moral dimension.

In these last few words we are again reminded of Proudfoot's category 4, the realm of values, which frequently takes a rather minor place in discussions between theologians and scientists. This is only natural, since science, *per se*, has essentially nothing to say about values, and is incapable of making value judgments.

Despite the vast amount of literature published on science and religion in recent years, Ian Barbour's *Issues in Science and Religion* is still one of the best books available, although it is nearly a quarter of a century old. If his 1989–1991 Gifford Lectures<sup>9</sup> maintain the same high standard, they may very well serve as the major resource book for the next quarter of a

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<sup>7</sup>Polkinghorne, *Science and Creation*, pages 97f.

<sup>8</sup>Jaki: *The Role of Faith in Physics*, pages 198f.

<sup>9</sup>The first volume of these, under the title *Religion in an Age of Science*, was advertised in *The Expository Times*, vol. 102, no. 1, October, 1990.

century. Among recent books Polkinghorne's *One World* is a useful supplement to Barbour, though its treatment of many topics is rather too concise for general use.

Discussions between scientists and theologians over matters of common interest are never likely to reach agreement on all issues. With rare exceptions, such as the three writers considered in this essay, neither scientists nor theologians are entirely happy discussing topics on the interface between science and religion in a mixed group. Perhaps some sort of truce is needed, even though it may be, in Habgood's words, an "uneasy truce". During a truce in warfare the two sides talk to each other. If the truce continues long enough, the two sides begin to appreciate each other's viewpoints. As they learn more about each other's hopes and aspirations the truce turns to friendship — even cooperation, and, occasionally, peace and unity.

# Appendix

## Augustine on Science

Augustine of Hippo, in section 39 in chapter 19 of Book 1 of his *The Literal Meaning of Genesis*<sup>10</sup> wrote:

Usually, even a non-Christian knows something about the earth, the heavens, and the other elements of this world, about the motion and orbit of the stars and even their size and relative positions, about the predictable eclipses of the sun and moon, the cycles of the years and the seasons, about the kinds of animals, shrubs, stones, and so forth, and this knowledge he holds to, as being certain from reason and experience. Now, it is a disgraceful and dangerous thing for an infidel to hear a Christian, presumably giving the meaning of Holy Scripture, talking nonsense on these topics; and we should take all means to prevent such an embarrassing situation, in which people show up vast ignorance in a Christian and laugh it to scorn. The shame is not so much that an ignorant individual is derided, but that people outside the household of faith think our sacred writers held such opinions, and, to the great loss of those for whose salvation we toil, the writers of our Scripture are criticized and rejected as unlearned men. If they find a Christian mistaken in a field which they themselves know well and hear him maintaining his foolish opinions about our books, how are they going to believe those books in matters concerning the resurrection of the dead, the hope of eternal life, and the kingdom of heaven, when they think their pages are full of falsehoods on facts which they themselves have learned from experience and the light of reason? Reckless and incompetent expounders of Holy Scripture bring untold trouble and sorrow on their wiser brethren when they are caught in one of their mischievous false opinions and are taken to task by those who are not bound by the authority of our sacred books. For then, to defend their utterly foolish and obviously untrue statements, they will try to call upon Holy Scripture for proof and even recite from memory many passages which they think support their position, although *they understand neither what they say nor the things about which they make assertions.*

The last 14 words here are quoted from I Timothy 1:7.

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<sup>10</sup>St. Augustine: *The Literal Meaning of Genesis*. Translated and annotated by John Hammond Taylor, S.J. Newman Press, New York, 1982. Volume 1, pages 42, 43.

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