

*The God of Hope
and the
End of the World*

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Introduction

For three years, an interdisciplinary group of scholars—scientists, social scientists, biblical scholars and theologians—met under the auspices of the Center of Theological Inquiry at Princeton. Their task was to reconsider, in the light of modern knowledge, the expression of Christian eschatological hope concerning the end of the world and concerning the fulfilment of the divine purpose for creation. One aspect of the group's activity was the evaluation of those currents of contemporary opinion about the shape and significance of the future that had been stirred up by the approach of the third Millennium. Another concern was how one may best articulate today the true nature of Christian hope and in what form one may credibly formulate and rationally defend the eschatological expectation of the attainment of God's goal for history. The results of our interaction were made available in a volume of essays entitled *The End of the World and the Ends of God*, edited by Michael Welker and myself.¹

1. J. C. Polkinghorne and M. Welker (eds.), *The End of the World and the Ends of God*, Trinity Press International, 2000; referred throughout as *Ends*.

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We believed that there is much of interest and value in that publication, but we also recognised that the essays there presented have varying degrees of specialisation and that they make significant intellectual demands on their readers. As its labours drew to a close, the group decided that there would also be merit in there being a smaller book, drawing inspiration from *Ends* but having the unity that would come from its having a single author. This second book would seek to address the issues in an intellectually serious manner, but it would be less full of scholarly detail than its parent volume. Since I like that kind of task, I volunteered to undertake this piece of writing and I was given the generous encouragement of my colleagues to set to work on the present volume.

This book is not a condensation or a digest of *Ends*. It will be clear, both explicitly in the quotations and references given and also implicitly in the lines of argument set down, that I am greatly indebted to the ideas and critiques that we shared together in the stimulating discussions of our group, and which were set out in our joint publication. Yet I have felt free to impose my own shaping on the material here presented and to state conclusions in accordance with my own beliefs and understanding. Inevitably, I have had to cover many topics on which I can make no claim to be an expert. This too has influenced the way in which this book has been written. For example, in the section relating to the biblical material, I have sought to survey themes derived from the Old and New Testaments generally, in contrast to the detailed scholarly exegeses of particular selected passages that are given in *Ends*.

Any treatment of eschatology requires the exploration of many kinds of insight, for it is concerned with what may be held to be a fitting fulfilment of the history of the universe

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and the history of humanity. Ultimately the issue is whether we live in a world that makes sense not just now, but totally and for ever. The thesis of this book is that Christian belief provides the essential resource for answering this fundamental question. That is the reason why the central section of my argument is concerned with a survey of biblical material and the final section develops theological reflection on the nature of eschatological hope. If, as I believe, any hope of a destiny beyond death can ultimately rest only on the faithfulness of God the Creator, then appeal to the revelatory insights by which that divine character has been made known is absolutely fundamental to the discussion. I understand revelation not as being propositional knowledge ineffably conveyed, but as the record of the particularly transparent people and events through which God has graciously shown forth the divine nature.² For the Christian, this awareness centres on the life, death and resurrection of Jesus Christ. Yet, while appeal to past experience and insight is indispensable, it is perfectly proper—indeed necessary—to ask how credible these eschatological assertions are today. Hence the discussion in the first section of material drawn from contemporary science and culture.

To a degree, the distinction between the three phases of the argument cannot be maintained and confined neatly within the three relevant sections of the book. The complex patterns interweaving together the three kinds of insight preclude an absolutely rigid separation, as will become clear as the argument is developed. Let me make it plain, also, that I

2. See J. C. Polkinghorne, *Faith, Science and Understanding*, SPCK/Yale University Press, 2001, ch. 3.

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do not claim to ‘prove’ Christian eschatology. Proof is an inappropriately cut-and-dried category for the discussion of any kind of profound metaphysical issue. What I am seeking to do is to present the motivations for Christian eschatological hope and to show that this hope is one that is intelligible and defensible in the twenty-first century.

In the compass of a short book I have sought to paint a large canvas, with science, culture, scripture and theology all on the palette. Inevitably the brush strokes are bold, for I am seeking to convince by the significance of the whole, without essaying a meticulous depiction of every detail. One might say that the style is impressionistic rather than Flemish in its character. I hope that such a treatment will be found helpful and I direct the reader anxious for more minute discussion to consult the references given, including the essays in *Ends*.

The book begins with the exploration of the general setting within which contemporary eschatological thinking takes place. In chapter 1 we see that science presents us with the picture of a universe that, despite its present fruitfulness, will eventually end in the futility of cosmic collapse or decay. This reliable prediction poses a sharp question to theology concerning how the latter conceives of the ultimate fulfilment of God’s creation. If the meta-story that theology seeks to tell is to carry conviction, it will have to include elements of both continuity and discontinuity in the linkages that it makes between the present universe and its destiny beyond its death.

Chapter 2 considers the features of current physical process that may be expected to be preserved as aspects of the continuity side of a credible eschatology. Of particular significance are both the way in which information is coming to take its place alongside energy in the fundamental concep-

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tual vocabulary of twenty-first century science and also the role of temporal process in the unfolding history of the world. This chapter also surveys, and rejects as inadequate, certain metascientific responses that deny both the need and the possibility of looking beyond the extrapolation of present physical understanding.

Chapter 3 moves from the impersonal perspective of natural science to the more personal domain of the human sciences. The fundamental concept of hope is given some discussion in psychological terms, distinguishing it both from optimism and from wishful thinking. Brief notice is taken of claims relating to paranormal experiences, but the issues involved are considered to be too unclear and too uncertain to play any role in the subsequent development of the argument.

Chapter 4 moves on to consider some relevant issues arising from general culture. Stress is laid on the significance of a 'hot' cultural memory that engages with preceding generations in a way that liberates people from the limitation of the contemporary and releases them from a feeling of necessity to seek instant satisfaction. The shattered utopian dreams of the nineteenth century, and the demonic experiences of war and genocide in the twentieth century, have to be acknowledged and dealt with in the course of forming twenty-first century hopes and expectations. A generous metaphysical stance that transcends an arid physicalist reductionism, together with a 'thick' concept of the nature of temporality that delivers human beings from being in thrall to the immediate demands of the present, are both indispensable elements in framing an adequate context for eschatological thought.

Chapters 5 to 7 deal with the biblical material, surveying the scene in broad conceptual terms. Here we consider

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the foundational events and insights which, together with the continuing experience of the worshipping community of the Church, constitute the primary sources of Christian eschatological thinking. Central to the discussion in chapter 6 is the consideration of the evidence for the resurrection of Jesus Christ and the evaluation of the central role that his resurrection plays in Christian eschatological thinking. Paul's extended treatment of the relevant issues in 1 Corinthians 15 displays the apostle's engagement with the theme of continuity/discontinuity. Another important Pauline expression of the same eschatological tension is in terms of the old and new creations (chapter 7).

The final, theological section of the book reflects on the material that has gone before, seeking to make intelligible the hope of human and cosmic destinies beyond death and providing the warrant for such belief. It begins with a return to the theme of hope. Chapter 8 looks to the God whose steadfast love is the only ground of a true and everlasting hope. Sympathetic consideration is given to aspects of a realised eschatology located in the present (and particularly related to the eucharistic experience of the Church), but it is also claimed that a future-oriented element involving ultimate forgiveness and joy is indispensable to a fully articulated and convincing eschatology.

Chapter 9 considers how one may take the psychosomatic unity of humankind seriously and still retain a usable concept of the soul. The latter is conceived of as the information-bearing pattern carried by the matter of the body, a revival in modern dress of the Aristotelian-Thomistic idea of the soul as the form of the body. It is claimed to be a coherent hope that God will hold that pattern in the divine memory follow-

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ing its dissolution at death, and then finally restore a person's full humanity through the re-embodiment of the soul in the final great act of resurrection.

Chapter 10 considers what will be the context for that re-embodiment. It sees it as being the redeemed 'matter' of the new creation which will constitute the ultimate destiny of this present universe beyond its anticipated end in futility. The empty tomb has a key significance here as the enacted sign that matter as well as humanity participates in the seminal event of Christ's resurrection. This present world has the structure and physical fabric appropriate to a creation allowed to evolve and 'make itself' and it is, therefore, a universe in which death is the necessary cost of new life and a creation in which creatures exist at some epistemic distance from their Creator. However, it is perfectly coherent to believe that the new creation will be given a different character. It will be closely integrated with the energies and life of God and so its 'matter' may be expected to be endowed with different divinely bestowed properties that will free it from the shackles of transience and mortality. Nevertheless, it is also claimed that continuing, if redeemed, temporal process will be part of the new creation and some criticisms are made of the eschatological views of Wolfhart Pannenberg and Jürgen Moltmann that run contrary to this picture. Chapters 9 and 10 together set out the form of human hope as being death and resurrection, rather than some kind of spiritual survival.

Chapter 11 then considers the life of the world to come, organised around the theme of the Four Last Things: death, judgement, heaven, hell. Significant ideas that emerge include: the offer of divine mercy is not withdrawn at death, but neither will it be imposed on those who continue to refuse it post

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mortem; the hopefulness of eschatological expectation includes the understanding of a purgatorial process of judgment; the life of the world to come will have its own 'time' and history in which the redeemed participate in the unending exploration of the infinite riches of the divine nature.

In conclusion, chapter 12 points out certain differences between the approaches of systematic theologians and of scientist-theologians to eschatological matters. It then gives an account of John Hick's idea of eschatological verification and concludes by setting out four criteria whose satisfaction is necessary not only for an adequate eschatology, but also for a fully credible theology.

There are important elements in common between *Ends* and the present book. Both are based on a critical realist understanding of the nature of the scientific and theological enterprises.³ Neither discipline is concerned merely with pragmatically useful manners of speaking but each seeks, within the necessary limitations of human ability to gain knowledge, to concern itself, respectively, with the world and with God as they actually are. In endeavouring to fulfil this task, both science and theology have to express their belief in the existence of unseen realities, be they confined quarks forever hidden within nuclear matter or be it the invisible reality of the divine presence. In each case, the justification for such a claim is the same: the appeal to what is not directly perceptible makes sense of great swathes of more accessible experience. It is the power to make experience intelligible that proffers us the key to the nature of reality. A realist understanding of the charac-

3. For a fuller discussion of these issues, see J. C. Polkinghorne, *Beyond Science*, Cambridge University Press, 1996, ch. 1; *Belief in God in an Age of Science*, Yale University Press, 1998, chs. 2 and 5.

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ter of both science and theology is essential for the project of this book.

If science were not giving us verisimilitudinous knowledge of the nature of the physical world, its prognostications about the future of the universe would lose their force and the sharpness of the challenge they present to theology would be blunted. If theology were not concerned with a verisimilitudinous understanding of the nature of a faithful Creator, its attempts to speak of eschatological matters would amount to no more than the disguised exercise of a technique of consolation for the uncertainties of the present. It is because both, in their different ways, are telling us about the reality within which we live, that they are capable of fruitful interaction with each other.

This interaction is of particular significance for eschatology. The ground bass of the discussion, both here and in *Ends*, is the necessity of an interplay between continuity and discontinuity in speaking of God's purposes beyond the end of history. Without an element of continuity, the story of the eschaton would simply be a second story, with no coherent connection with the presently unfolding story of this creation. Those of us who are participants in the present process of the world would have no role or interest in that second story. Without an element of discontinuity, however, that second story would simply be a redundant repetition of the first. This duality of sameness and change is implied in the Christian tradition by the use of phrases such as 'the new creation' and 'the resurrection of the body'. It will be a principal preoccupation in what follows to explore what meaning can, with integrity, be attached today to such a combination of continuity and discontinuity. Science has a role to play in this discussion because

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its account of present process can offer insight into what aspects of that process's character may be expected to be preserved in fulfilling the constraint of continuity. For its part, theology can offer insight into how God's free action may be expected to bring about the kind of discontinuity essential for the ultimate fulfilment of the divine purpose. For the Christian theologian, a prime source of this latter insight will be the resurrection of Jesus Christ. It is the element of discontinuity—the expectation of the unexpected—that distinguishes theological eschatology from a secular futurology.⁴

My conviction is that it is a rich theological account, Trinitarian and incarnational in its foundations, that alone will furnish the basis of a defensible and intelligible eschatological hope in the twenty-first century. A scientist-theologian colleague, Arthur Peacocke, has recently expressed a different view:

Furthermore, we have to ask, in what is much Christian eschatological talk of eschatology and the future based? Cosmology predicts with very great certainty the demise of this planet and all life on it, including ours. What is the cash value of talk about “a new heaven and a new earth”? The only propounded basis for this seems to me to be the imaginings of one late-first-century writer (in Revelation) and the belief that the material of Jesus' physical body was transformed to leave the empty tomb. I have already indicated that the latter is at least debatable and the former can scarcely be evidence. So what is left is belief in the character of God as love and that God has taken at least one human being who was fully open to the divine presence into the divine life—the resurrection and ascen-

4. See A. C. Thiselton in D. Fergusson and M. Sarot (eds.), *The Future as God's Gift*, T & T Clark, 2000, pp. 9–10.

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sion of Jesus. Is not all the rest of Christian eschatology but empty speculation?⁵

While I respect the scrupulosity that prompts Peacocke's highly reserved approach, I believe his stance to be mistaken. We both share the conviction that trust in the God of love is the only ground for human expectation of a destiny beyond death, but I believe that it is necessary and possible to enquire more closely and specifically into how that steadfast love has been, and will be, acted out in history and beyond history. In the course of this exercise one may hope to gain some insight into the 'cash value' of a phrase such as the new heaven and the new earth. Some speculation is certainly involved—just as it is in some of the detailed prognostications of the physical cosmologists—but I do not believe that this is an 'empty' exercise. Rather it is one that is filled with Christian experience, insight and hope. In both science and theology, our anticipations of the future are influenced by our understandings of the past and present.

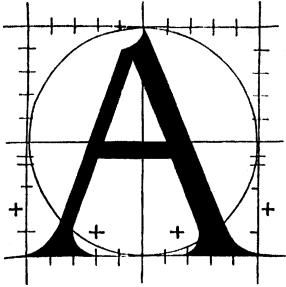
The Introduction to *Ends* concludes with a statement of the authors' stance and intent: 'The writers of this book share a common faith in a faithful Creator, a merciful Redeemer and a sanctifying Spirit. They believe that it is of the highest importance that Christians and the Christian church should not lose nerve in witnessing to our generation about the eschatological hope that is before us. They offer this book as a resource toward that end'.⁶ It is in the same spirit, and with the same intent in mind, that I offer this slimmer volume.

5. A. R. Peacocke, *Zygon* 35 (2000), p. 135.

6. *Ends*, p. 13.

CHAPTER ONE

Cosmic Process: Past and Future



s a prologue to our theological consideration of eschatology, we shall see what resources are available to us from culture in general and from science in particular. Because what is to come is related to what has been, we shall begin by considering science's account of the cosmic past and then its prognostications of the cosmic future.

EVOLVING FRUITFULNESS

The universe as we know it today emerged from the fiery singularity of the big bang, some fifteen billion years ago. Initially that world was extremely simple, being no more than an almost uniform expanding ball of energy. In the course of its long evolutionary history, the universe has become structured and diversified to a very high degree. The first generation of stars and galaxies condensed through the effects of gravity,

which enhanced the small fluctuations of density present in the initial state of the cosmos. Within the interior nuclear furnaces of these first generation stars, many new chemical elements were formed, supplementing the hydrogen and helium that had constituted the primordial matter of the cosmos after the first three minutes of its bewilderingly rapid transformations of matter/energy. These chemical raw materials were then scattered abroad, and further augmented in their variety, through the effect of supernova explosions. When a second generation of stars and planets came into being, there was then available the appropriate chemical context within which carbon-based life could develop, here on Earth and perhaps on many other planets. Eventually the shuffling explorations of potentiality working through terrestrial biological evolution led to the appearance of self-conscious beings, the most astonishing development that we know about in all those fifteen billion years of cosmic history. In humanity, the universe had become aware of itself. As a corollary, science became a possibility, so that we are able to tell the story of our origins within the long history of the universe.

Although the universe appears to have been lifeless for the first eleven billion years of its existence, there is a real sense in which it was pregnant with the possibility of life from the very beginning. Only because the balance between the fundamental forces of gravity and electromagnetism is what it is and no different, have stars been able to burn for the billions of years that are necessary if they are to be able to fuel the development of life on one of their planets. Only because the laws of nuclear physics are what they are and no different, has the range of chemical elements necessary for carbon-based life been produced by the stars, from whose dead ashes we and

all other living creatures here on Earth are made. This remarkable collection of scientific insights into the ‘finely tuned’ specificity of a biologically generative universe has been called the Anthropic Principle.¹ Of course, it is the generality of carbon-based life rather than the particularity of *homo sapiens* that is the real concern of the Principle.

Evolutionary history seems to unfold through the interplay of two contrasting tendencies: ‘chance’ (by which is meant the particularity of historical contingency, that this happens rather than that), and ‘necessity’ (by which is meant the generality of the lawfully regular environment within which the process is played out, the reliability of the world). No one supposes that the early universe was pregnant with the genus *homo*, but if natural necessity had not taken the form it actually does, then the chance explorations of contingent possibility would have been quite unable of themselves to bring about the fruitfulness of life as we know it. There would have been no carbon-based life because there would have been no carbon.

The scientific facts on which the Anthropic Principle is based are not open to doubt. Much contention, however, relates to what deeper metaphysical significance might or might not be attributed to these remarkable insights.² Such finely tuned potentiality might be held to indicate that there was a purpose being fulfilled in cosmic history, but those who (like the author) take that view have to be prepared to consider a

1. J. D. Barrow and F. J. Tipler, *The Anthropic Cosmological Principle*, Oxford University Press, 1986; J. Leslie, *Universes*, Routledge, 1989.

2. Barrow and Tipler, *Anthropic Cosmological Principle*; Leslie, *Universes*; and J. C. Polkinghorne, *Reason and Reality*, SPCK/Trinity Press International, 1991, ch. 6.

number of other scientific insights of a rather different character, relating both to past events and to future expectations.

THREAT

Sixty-five million years ago an asteroid at least ten kilometres in diameter struck the Earth. The hundred million megatons of energy generated by its impact brought about catastrophic consequences for the terrestrial environment, eliminating the dinosaurs which for more than one hundred and fifty million years had dominated life on Earth. Thereby the little furry mammals, who are our ancestors, were given their evolutionary opportunity. Here was 'chance' operating on a grand scale to influence the development of life.

Events of this magnitude may be expected to occur on average at intervals of the order of a hundred million years. Lesser, but still very destructive, incidents occur more frequently. In 1908 a meteorite only fifty metres or so in diameter exploded over a remote region of Siberia, devastating an area at least two thousand square kilometres in extent. Had the explosion occurred over a big city, all of it would have been destroyed. Very considerable technological effort and accuracy would be needed to provide artificial protection against the recurrence of catastrophes of even this more limited and localised kind. In 1994 watchers on our planet were given a ringside seat to observe the kind of consequences that could flow from a collision with circulating debris. Over a period of six days, twenty-one fragments of comet Shoemaker-Levy 9 crashed into Jupiter. None was larger than seven hundred metres in diameter, but they produced scars on the Jovian atmosphere some of which were larger than the size of the Earth and which

persisted for more than a year. The solar system is a dangerous environment, full of threats.

Other external dangers to our life on Earth, unpredictable in their onset, could arise from distant events such as a supernova explosion in our part of the galaxy, or the collision of two neutron stars to form a black hole. Either occurrence could deluge our planet with highly damaging radiation. Perhaps we give comparatively little attention to these external threats because of their largely unpredictable character and because the timescales within which they are likely to happen are very long compared with a human generation, or even with recorded human history.

Further threats to life originate within the planet itself, for example from viral or bacterial mutations, of which the impact of the HIV virus is an anticipatory experience. Some can arise from human hubris or carelessness, as anxieties about nuclear war and global pollution illustrate clearly enough. The continuing increase of the world's population serves to enhance the likelihood of disasters of this latter kind.

Many of these home-grown catastrophes could be very destructive but it is unlikely that they would wipe out human or animal life completely. However that life itself, in its intrinsic nature, is not inherently stable, for the average biological lifetime of a species is only a few million years before evolution may be expected to produce its successor. It is hard to know what this general fact implies for the future of human life, for in our case the ordinary Darwinian process has been considerably modified by the Lamarckian process of cultural evolution. The human power to transmit acquired knowledge across the generations is much more effective than the slow and uncertain process of the natural selection of genetic varia-

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tions. In just a few thousands of years, the effects of human cultural development have produced enormous consequences for the terrestrial environment and for other species. Humanity now stands at the threshold of being able to intervene directly in the process of life itself, through the ambiguous powers conferred upon it by advances in genetic engineering.

The incidence of these threats is largely uncertain in its detail but, on a statistical basis, we can say that some are likely to occur eventually. The fact that life has survived on Earth for between three and four billion years, despite at least five major mass extinctions to which the fossil record testifies, shows that there is a certain resilience present in carbon-based life as a whole. However, there are further kinds of catastrophe that are certain to occur and which will be absolutely destructive in their consequences.

CERTAIN CATASTROPHES

The Sun shines through the effects of its internal nuclear reactions turning its hydrogen into helium. In about five billion years time, all the core hydrogen will be exhausted and the Sun will then swell to become a red giant, burning any life surviving on Earth into a frazzle in the process. Our understanding of the course of stellar evolution is good enough to make this prediction absolutely reliable.

Of course, by then it is possible that terrestrial life will have migrated elsewhere in the galaxy. However, the universe itself faces a highly problematic future. Its long-term history is controlled by the competing effects of expansion (the 'explosive' consequences of the big bang) and gravity (drawing matter together). These contrasting tendencies are very

evenly balanced and we do not know for certain which will win in the end. If expansion predominates (the possibility currently favoured by most cosmologists), cosmic history will continue for ever in a world growing steadily colder and more dilute. Eventually, all will decay into low grade radiation. If gravity predominates, the present expansion will one day be halted and reversed. What began with the big bang will end with the big crunch, as the universe implodes into a cosmic melting pot. The timescales for these processes are immensely long, spanning many tens of billions of years, but one or other of them is a certain prognostication of the cosmic future. However fruitful the universe may seem today, its end lies in futility. It is perhaps not surprising that the distinguished American theoretical physicist Steven Weinberg, writing within the limited horizon of an atheist physicalism and with science alone as his guide, could say that the more he understood the universe, the more it seemed to him to be pointless.³ Here is a challenge to which theology must respond. As William Stoeger says, 'if we are to take the truth discovered by the sciences seriously, denying the scientific description of death and the more reliably supported accounts of eventual life-ending and earth-ending catastrophes is really not an option'.⁴

QUESTIONS TO THEOLOGY

Jewish and Christian thinking takes seriously the reiterated divine statements in Genesis 1 that creation is 'good'. Although this claim is supported by science's discernment of the ratio-

3. S. Weinberg, *The First Three Minutes*, A. Deutsch, 1977, p. 143.

4. W. Stoeger, *Ends*, p. 19.

nal beauty and fruitful history of the universe, this goodness seems significantly qualified by the catastrophes and ultimate futility that we have been considering. Theology must negotiate these issues carefully. On the one hand, it would deny the reality of the present world as God's creation if it relied solely on 'pie in the sky' to come, yet, on the other hand, its account is incomplete on its own terms if it does not also point to a credible future hope beyond the demise of this universe.

Undoubtedly, in contemporary Western society, the most immediate threat to religious belief in an ultimately hopeful future is felt to lie not in the longer-term global threats we have been discussing, but in the short-term prospect of certain individual death, together with the widely held view that it results in the annihilation of the person. Of itself, science can only speak of presently embodied life and from its own resources it does not offer grounds for believing in the continuation of that life beyond the death of the body. To neuroscience, the mind appears to be ineluctably linked with the brain and so expected to perish with its decay. We shall see subsequently that Christian theology can fully accept a psychosomatic understanding of the human being, but it does not accept the further implications that are drawn from this by an atheistic style of thinking. That is because theology bases its post mortem hope on a reality inaccessible to scientific investigation, the faithfulness of the living God. In a similar way, theology can accept science's insight that an evolving world is one in which death is the necessary cost of new life, without thereby being condemned to supposing that the present process of the world represents the only form that the divine creative power might sustain in being. These issues await our

later consideration. Meanwhile, we return to the significance of the catastrophes described in this chapter.

The spatial scale of much theological thinking is terrestrial, its timescale that of human history. Yet theology's real concern must be able to embrace the whole of created reality and the totality of cosmic history. In retrospect, in relation to the doctrine of creation, this has become widely acknowledged. Prospectively, in relation to eschatological fulfilment, there has been less extensive acceptance of all that this entails. But, if we are concerned with questions of ultimate significance, we cannot restrict ourselves to the domesticated horizon of simple human recollection and human expectation. The importance of the fact of cosmic collapse or decay is not diminished by its being so many billions of years in the future.

The gloomy prognostications of scientific cosmology press upon theology the necessity to recognise the seriousness of future threats and the vast timescales over which they operate. Whatever hopes there might be of human progress within history, they can amount to no more than a stay of execution of a sentence of inevitable futility. It is clear that a kind of evolutionary optimism that seeks a lasting fulfilment within the unfolding process of the present world is just not possible for us. Heraclitus was right, and all is in a state of flux. 'In our world, the cost of the evolution of novelty is the certainty of its impermanence'.⁵ Not only is this true of species, but it is true also of the whole of carbon-based life, everywhere it may come to exist. Eventually it will prove only to have been a transient episode in cosmic history. As far as science is right in describing the future as the extrapolation of the past and present, the

5. J. C. Polkinghorne, *Ends*, p. 39.

world will certainly not end in the attainment of some climactic Ω point,⁶ but in the whimper of cold decay or the bang of fiery collapse. An old-fashioned eschatology had as one of its slogans *Endzeit* is *Urzeit*, envisaging fulfilment as the restoration of a paradisaical beginning that had been marred by the primeval disaster of the Fall. Ironically, a contemporary scientific cosmology could adopt the same slogan, but with the pessimistic prediction that the fire of the big bang will be mirrored by the fire of the big crunch.

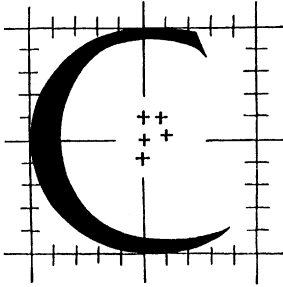
‘As far as science is right in describing the future . . . ? But theology claims that what is ultimate is not physical process but the will and purpose of God the Creator. God’s final intentions will no more be frustrated by cosmic death on a timescale of tens of billions of years than they are by human death on a timescale of tens of years. The ultimate future does not belong to scientific extrapolation but to divine faithfulness. The credibility and meaning of that claim was the subject of the project conducted at the Center of Theological Inquiry at Princeton, which led to the publication of *The End of the World and the Ends of God*. As we have already noted, a persistent theme in that enquiry, and one which will also undergird the discussion of this book, was that a credible eschatological hope must involve both *continuity and discontinuity*. Without an element of continuity there is no real hope being expressed for this creation beyond its death; without an element of discontinuity, the prospect would be that of the non-hope of mere unending repetition. While it is for theology to say what it can about the ‘new’ that God will bring into being, if that new is to be understood as the eschatological transformation of the old,

6. Cf. P. Teilhard de Chardin, *The Phenomenon of Man*, Collins, 1959.

then science may have some modest role to play in clarifying what will be the necessary degree of continuity required for this to be the case. We must now consider what insights the natural sciences might have to offer to eschatological thinking in this way.

CHAPTER TWO

Insights from Natural Science



CERTAIN general features characterise our understanding of the nature and history of the present physical universe. If that universe is rightly understood as being a divine creation, we may see these characteristics as being pale but true reflections of the will of the Creator. In that case, one might expect that the eschatological continuity between old and new would preserve these properties in some appropriate way.

FEATURES OF THE PRESENT CREATION

Among aspects thus to be considered are process; relationality; information; and mathematics.

Process

We have already sketched the evolutionary history of the universe and of life on Earth. Through the intricate unfolding

of physical process, initial simplicity has generated immense complexity. Theologically one can understand this complexity as the result of creation's having been endowed by its Creator with a profound potentiality which it has then been allowed to explore and realise as it 'makes itself'. God is not the tyrannical puppeteer of the universe, pulling every string so that all must dance to the divine tune alone, but rather the Creator is the God whose nature of love is patient and subtle, content to achieve the divine purposes in an open and developing way, in which the creatures themselves collaborate.¹ If that is the case for this present world, one may expect that similar characteristics will persist in appropriate ways as expressions of God's will for creation's destiny beyond its death. In other words, eschatological discontinuity will not be so abrupt as to be an apocalyptic abolition of the old, wiping the cosmic slate clean in an act of almost magical tour de force and so severing all connection between the old and the new—any more than the present creation came into being ready-made and fully formed, out of nothing at a snap of the divine fingers. There must be sufficient continuity for the new to be seen to arise *ex vetere*,² out of the old, as the latter's redemption from futility. Yet there must also be enough discontinuity so that the new is not just a repetition of the old, as if it were just a further turning of the evolutionary wheel of change brought about through death and decay.

This universe is a world of temporal process and, if we believe in the consistency of the divine Creator, we should not expect that its successor will be so radically different that it

1. J. C. Polkinghorne (ed.), *The Work of Love*, SPCK/Eerdmans, 2001.

2. J. C. Polkinghorne, *Science and Christian Belief/The Faith of a Physicist*, SPCK/Princeton University Press, 1996, ch. 9.

is, by contrast, a world of timeless existence. It too will surely have its developing history, though a history characterised by persisting fulfilment rather than transient coming-to-be.

Taking scientific insight seriously encourages reflections of this kind. Later we shall have to see how theology is able to respond to the challenges they present.

Relationality

Newtonian science pictured the motions of individual atoms as taking place within the ‘container’ of absolute space and in the course of the unfolding of absolute time. Modern physics has totally replaced this picture with something altogether more holistic and relational. Einstein’s great discovery of general relativity tied together space, time and matter in a single physical package. Matter curves spacetime and the curvature of spacetime deflects the paths of matter. Thinking about them has to take a fully integrated form.

Quantum theory has shown that once two subatomic entities have interacted with each other, they remain mutually entangled, constituting effectively a single system, however far apart they may separate. Each retains a counter-intuitive power to influence the other instantaneously. This togetherness-in-separation, or non-locality, is called the EPR effect,³ and some beautiful experiments have verified it as a property of nature. It appears that even the subatomic world cannot properly be treated atomistically.

At the more everyday level of macroscopic phenomena, chaos theory has revealed the widespread existence of sys-

3. See, for example, J. C. Polkinghorne, *The Quantum World*, Longman/Princeton University Press, 1984, ch. 7.

tems exquisitely sensitive to the finest details of their circumstances, and this implies that entities of this kind can never be treated in isolation from the effects of their environment. The slightest nudge will totally change their future behaviour. In all these ways, a methodologically reductionist science has learned that physical reality cannot adequately be treated atomistically.

Such insights are congenial to Christian theology, the nature of whose triune God is founded in the relational exchange (*perichoresis*, as the theologians call it) between the Persons of the Holy Trinity. For eschatological thinking, this emphasis on relationality implies the inadequacy of a purely individual concept of human destiny. In connection with the human community, this insight has frequently been accepted. Yet in connection with humanity considered in relation to the rest of creation, this has been less widely acknowledged, for much theological thinking has been unduly anthropocentric in its focus, regarding the remainder of creation as being little more than a backdrop before which the human drama is being played out.

Information

The science of the twenty-first century is likely to concern itself to a significant extent with an increasing understanding of the properties of complex systems. So far little has been possible beyond the study of certain computerised models of networks of moderate complexity. Already, however, this ‘natural history’ encounter with specific instances has raised expectations of very significant discoveries awaiting those who will be able to penetrate beneath particular behaviour to discern the deeper theory that undoubtedly underlies the striking

phenomena displayed by the individual cases so far studied. Most impressive has been the capacity of such systems spontaneously to generate very considerable patterns of ordered behaviour.

The kind of effects concerned can be illustrated by a system studied by Stuart Kauffman.⁴ A physical realisation of his computer model would consist of a large array of light bulbs, each of which has its behaviour of being on or off correlated with the behaviours of two other bulbs somewhere in the array. If they are both on, it is more likely to be on also at the next step of the system's development. If the system is started off in some random configuration, with some bulbs on and some bulbs off, and then allowed to develop according to these rules, instead of just flickering away haphazardly for ever, the system soon settles down to cycling through a very limited number of particular on/off patterns. This unexpected behaviour represents the generation of an astonishing degree of overall orderliness. If there are 10,000 light bulbs in the array, there are about 10^{3000} possible configurations that might in principle occur. In practice, however, the system cycles through only about 100!

This remarkable generation of order out of chaos strongly suggests that if the behaviour of complex systems is to be described and understood adequately, this task will call not only for the conventional 'bits and pieces' account in terms of the interactions of constituents but also for a complementary holistic account in terms of the overall pattern of the whole. In scientific terms, one can say that the conventional picture of

4. S. Kauffman, *At Home in the Universe*, Oxford University Press, 1995, ch. 4.

energetic exchanges between particles will need to be supplemented by a description of the whole, framed in terms of the effects of information generation (that is to say, the specification of complex pattern).⁵

We see here the prospect of the revival of an antique notion, reclothed in modern dress. Aristotle had spoken of both matter (*hyle*) and form (*eidos*). We are just beginning to learn how to speak, in a parallel way, about energy and information. Just as Thomas Aquinas used the revived Aristotelian science of his day as an aid to his theological thinking, so we, in our time, may find theological value in making use of the analogical resource that these scientific developments offer us. In pursuit of our present eschatological task, we shall see later that this method may be of particular relevance to how we may understand the nature of the human soul.

Mathematics

Mathematics is the natural language of science. Fundamental physics, we have discovered, is always expressed in beautiful equations.⁶ In itself, that is quite a striking fact about the universe, and the deep intelligibility and rational beauty that it

5. Important issues will require further clarification as these ideas develop. For the use of the language of information/pattern to be appropriate, the results of process should not only be highly improbable but also exhibit some kind of specifiable order. Tricky problems of interpretation can be involved. A long string of letters in an unintelligible arrangement is a priori improbable as a string of equal length making an intelligible sentence, but the former might also convey information, and embody a pattern, if it were in a code to which one possessed the key. Discussions of some of the relevant issues, which were developed for different reasons and in very different contexts, can be found in P. Davies, *The Mind of God*, Simon and Schuster, 1992, ch. 5; W. A. Dembski, *Intelligent Design*, IVP, 1999, chs. 5 and 6.

6. J. C. Polkinghorne, *Beyond Science*, Cambridge University Press, 1996, pp. 79–80.

expresses have been seen as providing the basis for a revived and insightful kind of natural theology.⁷ A world shot through with such signs of mind may well be thought to reflect the Mind of its Creator.

Yet, what is mathematics itself? Its practitioners resist the suggestion that it is a constructive form of intellectual play. They believe that their researches are true discoveries, explorations of an already-existing reality.⁸ The prime numbers and the Mandelbrot set have always been 'there'. But 'where' have they been? If these convictions of the mathematicians are correct (as I believe them to be), then in addition to the physical world that the scientists investigate, there must be an everlasting noetic world of mathematical entities that the mathematicians investigate. These worlds may be thought of as being in some kind of complementary relationship with each other.⁹ Together they constitute dimensions of created reality.

These ideas are obliquely relevant to our central concern. Their principal consequence for our present purposes would be the enabling of an enlargement of the ontological imagination, arising from within science itself broadly construed, rather than from explicit considerations of a religious character. Once arguments of this kind have encouraged the thought that there might be more things in heaven and earth than can be accounted for by conventional scientific thinking, then the extra noetic dimension thus introduced into reality can also be seen, in a platonic fashion, as affording a lodging for those

7. See J. C. Polkinghorne, *Science and Creation*, SPCK, 1988, chs. 1 and 2.

8. J. C. Polkinghorne, *Belief in God in an Age of Science*, Yale University Press, 1998, ch. 6.

9. Polkinghorne, *Science and Creation*, ch. 5; *Faith, Science and Understanding*, SPCK/Yale University Press, 2000, ch. 5.4.

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powerful ideas of goodness and beauty that likewise seem to transcend notions of their being mere human contrivances. If there are elements of reality beyond the flux of time, then there might also be a destiny beyond the temporal ending of this world.

RESPONSES WITHIN SCIENCE

The universal futility that cosmology predicts as the world's fate has elicited a number of responses from scientists who are unwilling to look to religion for the possibility of a wider prospect beyond the end of physical process. These reactions have included defiance; a total view; 'physical eschatology'; and endless fertility.

Defiance

According to this point of view, the only fitting attitude is a stoic defiance in the face of threatened futility. All culture, including science, will be no more than a transient episode, but while human society lasts it represents a small island of self-created meaning, around which laps the ocean of cosmic meaninglessness. It was in this spirit that Weinberg wrote: 'The effort to understand the universe is one of the very few things that lifts human life a little above the level of farce and gives it some of the grace of tragedy'.¹⁰ This pessimistic view is not without its own austere nobility. It makes it very clear what is at stake in the discussion of eschatological issues. Far from being matters of mere speculation about vastly distant events, their concern is whether the universe is ultimately a cosmos or a chaos, a world whose history makes total sense

10. S. Weinberg, *The First Three Minutes*, A. Deutsch, 1977, p. 143.

or a world whose history is just a concatenation of one thing after another, a ‘tale told by an idiot, full of sound and fury, signifying nothing’, as Macbeth said.

A Total View

While the universe may end badly, perhaps it is to the complete sweep of cosmic history, considered as a whole from beginning to end, that we should look if we wish to discern its significance. Meaning is to be found in the whole process and not in individual events. Such an attitude would be reinforced if it were true, as some believe, that it is the atemporal entity of the whole spacetime continuum that is the true reality, and our impression that we participate in a moving historic present is a trick of human psychological perspective. This so-called ‘block universe’ account is often defended on two grounds said to be derived from science:¹¹ the failure of the equations of physics to accommodate the concept of ‘now’, and a claim that the fact that special relativity implies that differently moving observers make different judgements about the simultaneity of distant events shows that the distinction between past, present and future is an illusion. I do not believe that either of these arguments works. If physics fails to describe the present moment, so much the worse for physics. Its inability to include this fundamental aspect of human encounter with the world should be seen as doing no more than indicating the narrow limits of a purely physicalist understanding, rather than disposing of a basic human experience. As for relativity theory, observers’ judgements about the temporal ordering of distant

11. C. J. Isham and J. C. Polkinghorne, ‘The Debate over the Block Universe’, in R. J. Russell, N. Murphy and C. J. Isham (eds.), *Quantum Cosmology and the Laws of Nature*, Vatican Observatory, 1993, pp. 135-44.

events are always unambiguously *retrospective* (since signals about them can only be received when they are within the observer's backward lightcone), and so this can do nothing to establish the pre-existent reality of the future.

Nevertheless, Albert Einstein seems to have embraced the notion of the block universe. When his great friend Michele Besso died, Einstein wrote what was clearly intended to be a consolatory letter to his widow. In it, he said, 'Now he has departed a little ahead of me from this quaint world. This means nothing. For us faithful physicists, the separation between past, present and future has only the meaning of an illusion, though a persistent one'.¹²

The concept of an atemporally existent lifespan (one's personal world-line, one might say in scientific terms) is the scientific equivalent of process theology's idea of objective immortality,¹³ our complete life held in the memory of God. Both these ways of looking at human significance fall far short of total meaningfulness, for they relate simply to static preservation of what has been (including all its incompletenesses and frustrations and, a theologian would wish to say, its sinfulness) and they do not offer the hope of a dynamic fulfilment (in the course of which unfinished business is completed and hurts are healed and sins forgiven).

'Physical Eschatology'

While carbon-based life can have only a finite timespan, once intelligence has come into being in this way, maybe it will re-engineer its embodiment so as to preserve its activity how-

12. Quoted in M. Jammer, *Einstein and Religion*, Princeton University Press, 1999, p. 161.

13. See I. G. Barbour, *Religion and Science*, SCM Press, 1998, p. 304.

ever cosmic circumstances change. Advocates of a strong view of artificial intelligence believe that we are close to seeing this happen with the emergence of primitive forms of silicon-based 'life'.

Freeman Dyson has considered the case of a continually expanding universe, in which he believes that information-processing could continue indefinitely, albeit at ever slower rates and in large physical systems that would have to husband their dwindling energy supplies through enduring long periods of dormancy.¹⁴ Obviously, this scheme offers no future hope for humanity beyond the demise of carbon-based life. However, a much more ambitious proposal for another kind of physical eschatology has come from Frank Tipler.¹⁵ He considers the case of a collapsing universe, which he believes could be manipulated so that its final phase would correspond to the whole cosmos becoming an ever-faster racing computer, fueled by the shear energy of the collapse and capable of processing an infinite amount of information in its dying gasp. In a curious echo of Teilhard de Chardin, Tipler calls this ultimate cosmic computer Omega, regarding it as constituting a 'physical god'. He even believes that Ω would 'resurrect' human beings by creating computer emulations of them in the course of its final highly energetic phase. Tipler shows himself to be a kind of 'Southern Baptist atheist', as he seeks through his 'physical eschatology' to recapture and reconceive the language of old time religion, now translated into purely physicalist terms.

As an imaginative exercise, Tipler's proposal is some-

14. F. J. Dyson, *Infinite in Both Directions*, Harper and Row, 1988, ch. 6.

15. F. J. Tipler, *The Physics of Immortality*, Macmillan, 1994.

thing of a tour de force. As a serious eschatological proposition, it is highly unconvincing. Many objections can be made to it. We have good reasons to believe that human beings are much more than finite state machines ('computers made of meat'),¹⁶ so that the idea of resurrection through emulation (computer modelling) is not a coherent expectation. In any case, why should Omega be expected to be concerned with humanity? Tipler displays breathtaking boldness in the assumptions he is willing to make about the behaviour of matter in regimes very distant indeed from any of which we could claim to have sober scientific knowledge. Those bold speculators who talk about the very early universe have to make guesses about physical behaviour about 10^{-43} seconds after the big bang; Tipler is willing to guess behaviour $10^{-10^{10}}$ seconds away from the big crunch.

When the efforts of physical eschatology are properly evaluated, they seem simply to confirm our previous verdict that the physical process of this present universe can end only in futility. In this connection it is instructive to compare Tipler with Teilhard de Chardin,¹⁷ who also presents a picture of unfolding fulfilment within present process. Yet Teilhard's vision of the end is not computerisation but christogenesis; the inspiration of his thought is not physicalist but eucharistic. Christoph Schwöbel comments, 'It is this reference to the evolution of Christ which, before the eschaton, is

16. R. Penrose, *The Emperor's New Mind*, Oxford University Press, 1989, ch. 10; J. Searle, *Minds, Brains and Science*, BBC Publications, 1984; *The Rediscovery of the Mind*, MIT Press, 1992, ch. 2. In *Ends* (p. 42), Detlev Linke makes this point by drawing attention to the many timescales present in the brain, in contrast to the single standard clock of a computer.

17. P. Teilhard de Chardin, *The Divine Milieu*, Harper, 1960.

pre-actualised in holy communion which prevents Teilhard's thought from becoming pantheistic'.¹⁸ Tipler, on the other hand, devises the scenario of a sort of evolving pantheism. One may feel, as I do, that Teilhard concedes too much to the hopes of a kind of evolutionary optimism and that he takes too little account of scientific predictions of cosmic futility, but at least he rests his thinking on a credible theistic basis.

Endless Fertility

There are scientists who are endeavouring to apply quantum theory to the whole universe, despite our current ignorance of how to combine quantum theory and general relativity into the single account that would be needed for a true quantum cosmology.¹⁹ Speculations of this kind are interesting but uncertain and not much should be built upon them. Yet one proposal is of some interest for our present concern. It supposes that baby universes are continually bubbling up from fluctuations in the primeval ur-state, which is the quantum gravitational vacuum. Many such bubbles just fade away, but some are blown up, by a process called inflation, into entities of cosmic dimensions, enjoying cosmic lifetimes. We are believed, by those who espouse this view, to be living in one such long-lived fluctuation. In the end our particular bubble will burst, but others 'elsewhere' will come into existence as its successors. The cosmic pot will boil away 'for ever'. Even if something like this proposal were to prove to be correct, it would

18. C. Schwöbel, 'Last Things First', in D. Fergusson and M. Sarot (eds.), *The Future as God's Gift*, T & T Clark, 2000, p. 234.

19. See C. J. Isham, 'Quantum Theories of the Creation of the Universe', in Russell et al. (eds.), *Quantum Cosmology*, pp. 49-89.

only present a scene of occasional islands of transient meaningfulness erupting within an ocean of absurdity.

From its own unaided resources, natural science can do no more than present us with the contrast of a finely tuned and fruitful universe which is condemned to ultimate futility. If that paradox is to receive a resolution, it will be beyond the reach of science on its own. We shall have to explore whether theology can take us further by being both humble enough to learn what it can from science and also bold enough to hold firm to its own sources of insight and understanding.