



*Theology in the
Context of Science*

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Introduction

The past fifty years have seen the growth and flourishing of what have come to be called contextual theologies. The particular experiences and challenges that arise in a specific setting—whether its character is social and cultural (feminist insights; the liberation insights of the poor; and so on), or geographical and cultural (South-East Asia; Africa; and so on)—came to be recognised as providing new and stimulating ways of shaping theological thought. Of course, any particular viewpoint offers not only the prospect of new lines of sight, but it also carries with it the threat of new tricks of perspective. Yet these contextual developments have largely been welcomed, and their reception by the theological community has been positive.

This is in contrast to the way in which most theologians have related to the insights coming from another cultural context of considerable contemporary influence, namely that of modern science. The past fifty years also saw the growth and flourishing of much activity in the area of science and religion, but the manner in which this has been reported and received

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in the theological community at large has been different from the way in which that community has responded to insights derived from other specific contexts. There has certainly been a degree of awareness among theologians that a vigorous discussion is going on in the world of science and theology, but the books written, and the resources thus offered, have largely been conceived in the specific style of an ancillary, problem-tackling activity, concerned with a number of discrete and somewhat specialised issues (creation and cosmology; divine action and the laws of nature; and so on), rather than offering also a source of more general insight, expressed through shaping a style of theological thinking. I must confess that much of my own writing has been in the problem-oriented mode.

Because of the narrowness of the approach that has actually been taken in the interaction with science, it seems likely that a potentially helpful theological resource has been neglected. Of course, I am not suggesting that science can answer theology's questions for it, but simply proposing that there is a strategy for seeking truth through motivated belief which is natural in the context of science and which should be capable of useful extension beyond the latter's domain of proper concern, to yield also a particular way of framing theological discourse.

The style of thought naturally associated with the context of science has the character of what I have called 'bottom-up thinking'.¹ It seeks to evaluate the evidential particularities of experience before attempting to move to the formulation of wider forms of understanding. Scientists are wary of general

1. J. C. Polkinghorne, *Science and Christian Belief/The Faith of a Physicist*, SPCK, 1994/Fortress, 1996.

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arguments that fail to be submitted to the discipline of being sifted and assessed by comparison with specific instances. Often it is only the stubborn character of the reality actually encountered that is able to mould adequately the shape of our thought. Quite frequently it is found that modes of thinking are required which are counterintuitive in terms of prior rational expectation. The paradigm example from physics is the idiosyncratic nature of the subatomic quantum world.

If theological discussion is to proceed in the context of science in the way suggested, its account of divine creation must take fully into consideration the actual nature of the universe that we observe and the character of its history, both in its apparent fruitfulness and in its apparent wastefulness. Theology should not rest content with simply an abstract discussion of the concept of creation out of nothing. To take another example, the kind of logical and grammatical discussions concerning the meaning of the simplicity of the divine nature, or concerning the kind of atemporality that properly belongs to God—issues that so greatly occupied the thought of people in the later Middle Ages and which are the prime concern of many philosophical theologians today—have to be supplemented by more particular considerations. Close attention must be given of the actual detail of the data of divine revelatory disclosure and the way in which this constrains and sharpens the conclusions of general argument. Theology's concern is with the God of Abraham, Isaac, and Jacob as well as with the God of the philosophers. (Of course, it has also to take account of what other world faiths have to say about the nature of divinity.) To do so is not to devalue philosophical analysis, but to suggest that its attempted generality must be held in tension with the particularities of creation and revela-

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tion. Theodicy is high on the agenda of theology pursued in the context of science, as is a serious engagement with the significance of temporality, not only for creatures but also for the Creator (see chapter 3). The common academic convention of maintaining a degree of separation between systematic theology and biblical studies seems strange to the scientist, rather as if theory and experiment were to be assigned to different departments within physics, rather than inextricably intertwining with each other. Of course, individual scholars have their particular specialisations, but these should be pursued in active dialogue with colleagues with collateral interests.

I believe, therefore, that the field of science and religion should be treated as another form of contextual theology, rather than its role being seen simply as that of providing useful information which can be referred to as seems necessary—usually rather briefly and often as part of an apologetic exercise. The dialogue between science and religion can rightly seek to contribute to creative theological thinking itself, in complementary relationship with other forms of contextual theology. Failure on the part of most mainstream theologians to take this attitude provides, I believe, an explanation of a feeling among participants in the science and religion community that their work is often not taken with sufficient seriousness by many of their systematic theological colleagues. Most scientist-theologians are somewhat reticent about expressing this feeling, but I believe it to be quite widespread, and I think that it is intellectually healthy to acknowledge that this is so. I do not think that this unease is simply an indication of *folie de grandeur* on the part of our community. We know that what we have to offer is limited, and that by itself it is certainly insufficient for the great task of theological

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exploration, but our work deserves more than the occasional footnote.

This book is intended as a concise attempt to see what a scientific contextual theology might look like. According to what has been said, the project is presented as one that seeks to offer a distinctive style of thought and argument, as well as serving to provide a specific source of response to particular issues. This includes a rebuttal of the scientific claim, so often asserted today, of total scientific relevance and total theological irrelevance in the academy, a judgement which from time to time comes thundering across from the more polemical members of the atheistic community. What is being attempted in this volume stands in a kind of complementary relationship to an earlier book of mine, *Science and the Trinity*,² which sought to redress another form of imbalance by allowing theology to set a greater part of the agenda for the interdisciplinary dialogue between science and religion. My present concern focuses principally on the character of that dialogue, though of course specific issues will also arise in the course of the discussion. A number of the specific ideas discussed in this book can be found treated in detail elsewhere in the rapidly expanding literature dealing with science and religion, including discussions in my own writing. However, the way in which the material is here organised and presented differs from much of the latter form of writing, in a manner that corresponds to the difference between seeking general insight on the one hand and solving specific problems on the other. I hope that the resulting tone of discourse will result in a book that will

2. J. C. Polkinghorne, *Science and the Trinity*, SPCK/Yale University Press, 2004.

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be found interesting and accessible by a wide range of readers. Yet I must confess that in writing it I have also had in mind a particular audience, made up of theological students either at university or elsewhere (and even, one might hope, practising theologians), some of whom I would like to try to entice into taking into account with an enhanced degree of interest what the context of science can offer to theology as a whole. With this target in mind, as well as the needs of the general reader, I have not sought to go into more scientific detail than has seemed necessary in order to indicate the potential insight that I believe is made available by the pursuit of theology in the context of science. What is offered here is a programmatic indication of the value of the scientific contextual approach, rather than an exhaustive account of all matters that could be considered relevant.

Chapter 1 emphasises that theology has always been done in some particular context. Inevitably, what is offered is a view from somewhere. Examples drawn from the interactions with science, attempted by the small number of contemporary theologians concerned with such issues, suggest that the failure to make full use of the potentiality inherent in the scientific context has often arisen from conceptual confusions which could have been dispelled by closer attention to what the scientist-theologians—writers with a professional knowledge of science and a serious interest in theology—have actually had to say.

I am claiming that a substantial part of the influence of a contextual theology arises from the particular style of discourse in which it is naturally expressed. Of course, as I have already acknowledged, that gift in itself can be ambiguous,

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with the possibility of imposing narrowness of vision instead of offering breadth of understanding. The rise of deism, and eventually atheism, in the eighteenth century was undoubtedly due partly to the encouragement that contemporary science then appeared to give to a mechanistic mode of thought. However, in the twentieth century, science's picture of the physical world was drastically revised in the light of the discoveries of quantum theory and relativity. The clear and determinate world of Newtonian physics was replaced by something altogether more strange and subtle. The idea of mere mechanism simply died.

Chapter 2 discusses the changed manner of scientific discourse that has resulted from these twentieth-century scientific developments, and the implications of this for theology conducted in the context of science. Commonsense thinking is no longer to be considered an adequate guide to the character of physical process, and the more subtle approach that has proved necessary in science bears a degree of cousinly relationship to theology's wrestling with the mystery of deity.

The loss of what had previously seemed to be an unproblematic objectivity led physicists to appeal to intelligibility as the proper ground for belief in the reality of the physical world, including the existence of intrinsically unseen realities such as quarks. Modern physics also makes it plain that quantum entities can only be known in a manner that is in accord with their Heisenbergian uncertainty, thereby pointing to the fact that there is no universal form that epistemology has to take. The forms of knowledge appropriate to the everyday world and to the quantum world have completely different characters.

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These insights are helpful to theology's thinking in its own domain, and a kinship may be discerned between these two great forms of truth-seeking discourse.³ The unexpected strangeness and counterintuitive character of the physical world means that the instinctive question for a scientist to ask is not, 'Is it reasonable?', as if one knew beforehand the shape that rationality had to take, but the question, 'What makes you think that might be the case?', an enquiry open to the unexpected but demanding evidence to support the actual answer given. This readiness to accept well-motivated belief, however surprising its character might turn out to be, should encourage theology to adopt the bottom-up approach of grounding its own beliefs in actual experience, including the record of revelatory events in which the divine will and nature are believed to have been most clearly manifested. The interpretation of these disclosure events will necessarily involve subtle acts of evaluation, since revelation does not take the form of propositions unproblematically presented for unquestionable acceptance. Rather, revelation is the indispensable record of foundationally significant human encounters with sacred reality. The essence of rationality is the conformation of our mode of thought to the nature of the reality that we are seeking to think about. Just as there is no universal epistemology, so there is no universal form that rationality has to take. Once again, the difference between classical thinking and quantum thinking makes the point clearly enough in a scientific context. In the former case one has classical logic, with its law of the excluded middle (there is no intermediate possibility

3. See, J. C. Polkinghorne, *Quantum Physics and Theology*, SPCK/Yale University Press, 2007.

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between 'A' or 'not-A'), but in the latter case a different (quantum) logic is found to hold⁴ (since quantum theory can mix together seemingly incompatible possibilities, such as 'here' and 'there').

In both science and theology, the intertwining of experience and interpretation implies a degree of circularity, but this need not invalidate rational commitment to well-winnowed and well-motivated beliefs. In both disciplines, inference to the best explanation is a legitimate strategy to pursue. Neither science nor religion has access to absolute truth, indubitable beyond the possibility of a challenge. The kinship thus discerned between science and theology in their respective fields of search for truthful understanding rebuts the strident claims made by some atheists that theology is not a proper subject with a rightful place in the academy.

A different kind of discourse arises from the fact that an important element in many contextual theologies is provided by the ethical insights and demands that they articulate, as when liberation theology speaks of an option for the poor. Pure science is concerned simply with the search for truthful knowledge, but its offspring technology then takes that knowledge and uses it to acquire the power to get things done that were not possible previously. Yet not everything that can be done should be done and, if right choices are to be made, wisdom must be added to the gifts of knowledge and power. Science's formal distancing of itself from issues of value, expressed in the way in which it frames its argument in terms of what is found to happen rather than what ought to hap-

4. See, J. C. Polkinghorne, *Quantum Theory: A Very Short Introduction*, Oxford University Press, 2002, pp. 37-38, 87.

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pen, means that scientists must look beyond their discipline for help in addressing ethical issues. Chapter 2 concludes by briefly considering some of the general implications of what is involved in this ethical quest.

The temporal and spatial character of human experience is fundamental to the thought of both science and theology. Science's discovery of the significance of evolutionary processes at work over vast spans of history means that the role of time is not merely that of a means of indexing when events happened, but it has a formative role in bringing about the character of the present. What is now has to be understood in the light of what has been. For theology this means that a concept of continuously developing creation must play an essential part in its thinking.

Both science and theology face perplexities in relation to their understanding of the true nature of time. Chapter 3 considers these issues. While science constrains what can be said about such matters, it is not of itself sufficient to determine unique answers. Ultimately metaphysical decisions are required, which have to be made and defended on metaphysical grounds. It is perfectly proper for theological considerations to play a part in this process. The point is well illustrated by a discussion of the flow of time. Does our impression of the passage of time correspond to the fact that we actually live in a universe of unfolding becoming, or is that feeling simply a trick of human psychological perspective, imposed on us in a block universe whose true nature is held to correspond to the atemporal reality of the entire spacetime continuum? The latter concept has a degree of affinity with classical theology's picture of God's relationship to a creation seen from eternity 'all at once'; the former concept has an affinity with modern

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open theology. An evolving creation, in which the character of the present is constituted by the specificity of the past, suggests the theological possibility of a true divine engagement with created temporality. This view leads to the idea of a duality of eternity/temporality in the divine nature, embraced as a free kenotic decision on the part of a Creator who has chosen to relate in a temporal manner to the historically unfolding story of creation. This development provides a good illustration of how taking the context of science seriously can encourage a particular way of enhancing the conceptual scope of theological thinking. The openness of the resulting metaphysical picture can also be held to suggest a kenosis of divine omniscience, in which even God does not yet know the unformed future.

The concept of personhood is one of central concern for theology. At first sight it might seem that this is a topic on which the context of science might exercise little influence, since scientific investigation concerns itself solely with the impersonal dimensions of reality. Even neuroscience is not in a position to offer very much help. Its current investigations into brain processes, interesting and important though they are, still confront an unbridged gulf between the discourse of neural processing and the simplest forms of personal mental experience, such as seeing red or feeling hungry. The 'hard problems' of consciousness are hard indeed.

Much of science's great success has come from the secret weapon of experiment, a means of gaining knowledge which is conferred on it precisely by science's self-defining concentration on impersonal reality, thus permitting the repetition of particular investigations as often as desired. Yet chapter 4 points out that much more needs to be said about the actual

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practice of science itself than can be articulated in the formally impersonal discourse that science has chosen to adopt.

The fact is that if we are truly to understand what is happening in the world, a great enlargement of conceptual scope is required, taking the enquirer beyond the narrow limits imposed by scientific protocol. The deep intelligibility of the universe—a remarkable fact that science is happy enough to exploit but unable to explain—is nevertheless so significant a feature of the world as surely to demand its being treated as more than a happy accident. Beneath the surface appearance of the physical universe there lies a fundamental realm of profound order and rational beauty. One could say that science has discovered that the fabric of the cosmos is shot through with signs of mind, but it does not know why this should be so. Theology can render this discovery intelligible, through its understanding that the Mind of the Creator is the source of the wonderful order of the world.

The role of tacit skills of judgement exercised in scientific research, so insightfully explored by Michael Polanyi,⁵ makes it clear that the practice of a formally impersonal science is nevertheless intrinsically an activity of persons, having a character that means that it could never be delegated to a well-programmed computer. In its turn, theology in the context of science has to take the psychosomatic nature of human beings very seriously. Some modest help is afforded here by an enlargement taking place in science's own set of conceptual resources, due to contemporary developments in the study of complex systems. These have suggested the necessity of complementing the traditional reductionist story of physics,

5. M. Polanyi, *Personal Knowledge*, Routledge and Kegan Paul, 1958.

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framed in terms of exchanges of energy between constituents, with an holistic account employing a developed concept of 'active information'. This work is at a very preliminary stage, but it promises to afford an enriched scientific context which should be of real value to theology.

Other topics considered in chapter 4 include the need for an adequate understanding of the full context of evolutionary process, the nature of consciousness, and the role of value. The latter topic, together with that of the deep cosmic intelligibility already noted, offers the possibility of a revised approach to natural theology, understood as being in a complementary relationship to science, rather than as an attempt to rival it in its proper domain, and concerned with understanding what science itself has to treat merely as brute fact. The claimed achievement of this new natural theology is satisfying insight rather than indubitable proof. Scientific questions may indeed be expected to receive scientific answers, but there are many questions which are both meaningful and necessary to ask, but which lie outside the self-limited confines of science. Some of these are metaquestions that arise from the experience of doing science, but which then take the enquirer beyond its narrow borders.

Chapter 5 turns from the rather general ways in which the context of science can influence styles of theological discourse, in order to consider three specifically focused points of contact: creation, providence, and relationality. Involved in each case is a topic (the history of the universe, the causal character of cosmic process, the remarkable degree of interconnectedness present in the physical world) about whose understanding both science and theology have things to say. Of course, their perspectives are distinct and the questions

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that they address are different. There is no logical entailment from one discipline to the other, but one may rightly expect to be able to discern a degree of consonance between what each has to say.

The doctrine of creation asserts the sustaining will of God to be the ground of continuing cosmic history. Science's discovery of the rational transparency and rational beauty of the physical world is certainly consonant with the understanding that the structure of the universe is shaped by the Mind of its Creator. The remarkable set of scientific insights assembled under the rubric of the Anthropic Principle has shown that a universe capable of developing carbon-based life is a very particular world indeed, having had to be endowed with a very specific physical fabric in order to permit this fruitful possibility. This unanticipated scientific discovery is certainly congruent with belief that cosmic history is an expression of the fruitful purposes of the universe's Creator. The evolutionary character of the universe is consonant with a theological understanding that God's act of creation is a kenotic act of divine self-limitation, bringing into being a world in which creatures are allowed 'to make themselves'. In a creation of this kind, death is the necessary cost of the development of new life, and physical process has to operate 'at the edge of chaos', in regimes where chance and necessity, order and disorder, interlace. These scientific insights offer theology some modest help as it seeks to wrestle with the perplexing questions of theodicy. There is an inescapable shadow side to the fertility of evolutionary process.

Science's account of physical process is patchy (for example it is not fully understood how quantum physics and classical physics relate to each other) and it is characterised by

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widespread intrinsic unpredictabilities (as in quantum theory and chaos theory). Moreover, the nature of causality is not an issue capable of being settled by science alone, for it requires also an act of metaphysical decision. It is certainly clear that science has not established the causal closure of the world on its own naturalistic terms. In fact, it is perfectly possible to take the actually substantiated conclusions of physics and incorporate them into a metaphysical scheme that is compatible with the exercise of agency, both by human persons and by divine providence. The picture of a God whose interaction with creation operates within the open grain of nature has implications for theological expectations about the character of prayer and the discernment of providence.

In the twentieth century, science discovered remarkable degrees of relationality present in the physical world, at all levels from the subatomic to the cosmological. Understanding our apparent everyday experience of the separability of objects is far from being an unproblematically straightforward matter. This picture of a deeply relational universe is consonant with a theological belief in the trinitarian nature of that world's Creator.

This chapter illustrates how scientific insight can suggestively illuminate theological discourse, without pretending to determine it. The exploration of a complementary consonance between science and theology is the reason why there is no single chapter in the book with the heading 'God'. Rather than a self-contained analysis of the kind associated in works of philosophical theology with the topic *De Deo Uno*, the intertwining of scientific and theological insights, so natural to the discourse of this book, encourages treating the topic of deity *in via*, so to speak, as the manifold aspects of the divine

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economy, manifested in the works of creation, pass under review.

Scientists are often suspicious of religious belief because they think that it is based on unquestioning submission to an unchallengeable authority. I believe this to be a disastrous mistake on their part. Chapter 6 seeks to indicate how one may present motivations for Christian belief, using a bottom-up style of reasoning that moves from evidence to understanding in just the manner that we have seen to be appropriate to argument presented in the context of science. It is important that theology does not lose its nerve about appealing to the unique significance of revelatory events. As a test case, the discussion of the chapter centres on the resurrection of Jesus Christ, first considering the coherence of the idea of miracle and then indicating reasons for taking seriously the New Testament evidential claims of the appearances of the risen Christ and the finding of the empty tomb. The chapter concludes by moving outside the Christian context to acknowledge and discuss the perplexing issue of the apparent cognitive clashes that exist between the beliefs of the different world faith traditions.

Science's naturalistic stories always end in the eventual futility of death, not only in the case of individuals, but even in the case of the universe itself. Theology is able to speak of the hope of a destiny beyond death because it can appeal beyond current transience to the everlasting faithfulness of God. Science cannot speak about that kind of hope—either for it or against it—but its context does have some influence on how one might try to think about the credibility of the idea of a life beyond death for human beings. This contextual influence arises because a coherent idea of the possibility of the continuance of individual life post mortem requires fulfilling

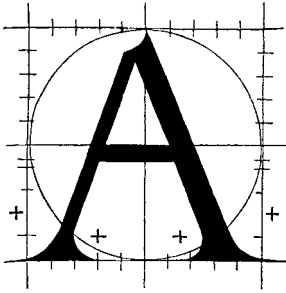
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conditions of both continuity and discontinuity, issues that are considered in chapter 7. The condition of continuity must be sufficient to ensure that it really is the same persons who died who are the ones that live again. The traditional carrier of continuity between life in this world and life in the world to come has been the soul. Yet the context of science encourages a psychosomatic view of humanity, which would prohibit the soul from being conceived in dualist terms as a detachable spiritual component, released at death from the fleshly entrapment of the body. However, the increasing recognition of the significance of the concept of information encourages re-conceiving the soul as the almost infinite information-bearing pattern carried by the matter of the body, a pattern which it is perfectly coherent to believe will be preserved by God beyond death and re-embodied in an ultimate eschatological act of resurrection. Those thus made alive again are surely not intended simply to die again, so that there is also a condition of discontinuity requiring that the 'matter' of the world to come shall not be subject to the thermodynamic drift to disorder that brings about futility in this world. Discussion indicates that it seems coherent to believe that God can bring about such a new form of matter.

A brief concluding postscript stresses that science and theology share in the great human quest for truth and understanding and that their fruitful interaction derives from this common concern.

CHAPTER ONE

Contextual Theology



LL theology is done in a context. The accounts that the theologians give us are not utterances delivered from some point of lofty detachment, independent of culture—views from nowhere, as it were—but they are all views from somewhere, offering finite and particular human perspectives onto the infinite reality of God. Each such perspective not only offers an opportunity for insight, but it is also open to the danger of imposing limitation and distortion. Specificity of context will make some aspects of the divine will and nature more readily accessible to theological recognition and understanding, while at the same time hiding others from easy view.

The earliest Christian theologians, the authors of the New Testament, wrote in the context of their heritage of contemporary Judaism and in varying degrees of engagement with the surrounding Graeco-Roman culture. Their writings offer unique and irreplaceable access to the story of the life,

death, and resurrection of Jesus Christ, together with indispensable accounts of how his first followers experienced and understood the life-transforming power that they believed had come to them from the risen Christ, mediated in the Church by the continuing work of the Holy Spirit. This means that these New Testament writings, together with the Old Testament books of the Hebrew Bible which were the New Testament authors' own scriptural context, create a biblical setting which is of fundamental importance for all subsequent Christian thinking. Yet this acknowledgement of the unique significance of scripture is by no means enough to establish an unambiguous and sufficient context for theology.

The biblical texts, which are often very concise in their expression of deep and challenging truths, stand in need of continuing exploratory interpretation, conducted in each succeeding Christian generation. Within the canon of the New Testament itself one finds a number of different treatments of theological themes, doubtless formulated within the different contexts that corresponded to the various early Christian communities in which oral tradition was propagated and the original documents eventually written. A comparison of the Pauline and Johannine writings, together with consideration of the approach taken by the unknown author of the Epistle to the Hebrews, makes this clear enough. The common affirmation of the unique status of Jesus, crucified and risen, is expressed by the different authors in contrasting ways which serve to complement each other.

The Christian theologian will see scripture as divinely inspired but humanly written. Its authors were inevitably influenced by the cultural context of their times, and a major exegetical task is to discriminate between what in their writ-

ings is of lasting significance and what is simply contemporary understanding to which we do not owe an unrevisable allegiance. Science has played a useful part in assisting these acts of judgement, so that, for example, when the psalmist says that God ‘has established the world; it shall never be moved’ (Psalm 93:1), we are able to recognise that he is using the cosmological understanding of his day to express the Creator’s faithfulness, rather than making a statement about the structure of the solar system. Galileo was to argue thus, making a point to which we shall return shortly.

In any case, the hermeneutic quest should not simply be for a single exclusive kind of interpretation, since there are a variety of levels at which the texts may properly be read.¹ Such richness of meaning is a common feature of all profound forms of literature, which always hold out the prospect of an overplus of significance awaiting the open and receptive reader. The notion of a plain text with a single meaning may suit the cookery book, but it will not do for writing that sets out to explore the multiple richness and depth of reality, either human or divine. The history of theological thought provides abundant examples of the recognition of the need for a many-levelled approach to scripture. In the patristic period, many of the Fathers used a scheme that discerned four dimensions of scriptural interpretation, corresponding to literal, symbolic, moral, and spiritual meanings. Even in a period such as Reformation times, when there was a greater tendency to employ a less nuanced interpretative strategy, and people were inclined to accept the idea that there is a plain meaning to be found

1. See, J. C. Polkinghorne, *Science and the Trinity*, SPCK/Yale University Press, 2004, ch. 2.

in the scriptural text that anyone who runs may read, the fact is that this approach actually led to a wide variety of different interpretative conclusions. Such diversity indicates clearly enough how problematic it is to suppose the irrelevance of particular contextual influences in shaping biblical interpretation. There is more than one way to strike a balance between the Epistle of James and the Epistle to the Romans in forming a theological concept of the role of good works.

The polysemic nature of scripture is sometimes a problem for scientists, who are often more used to the sharp clarity of mathematical argument. Yet even in mathematics not all is expressed on the surface. Kurt Gödel showed that axiomatised systems, sufficiently complex to contain the integers, cannot establish their own consistency. If they are assumed to be consistent, then it can be shown that they contain mathematical truths that are expressible, but not provable, within the confines of the system. Thus even here, in this most abstract of subjects, the richness of reality eludes tight specification. Truth is more than theoremhood.

While a few religiously minded scientists have been tempted to treat the Bible as though it were a textbook in which one could look up the ready-made answers to every theological question, a better metaphor is surely that of the laboratory notebook, in which are recorded accounts of foundational encounters involving acts of divine self-disclosure, essential for theological theory-making, but leading to and needing further reflective interpretation. Revelation itself is experiential rather than propositional. It provides the raw material for the work of the bottom-up theological thinker, seeking truth through assessment of the motivations for belief.

At certain times, a particular contemporary philosophical style has moulded the context of thought, substantially influencing the resulting shape of theological discourse, without completely determining its character. Augustine was heavily influenced by the neo-platonism of his day, and Aquinas owed much to the recovery of a lost Aristotelianism that took place in the course of the thirteenth century. Yet neither slavishly followed their philosophical mentors at every point. For example, Aquinas rejected Aristotelian belief in the eternity of the world. In the nineteenth century, and on into the twentieth, many German theologians have seemed to write with Kant looking over one shoulder and Hegel looking over the other. The process philosophy of Alfred North Whitehead has substantially influenced a number of present-day scientist-theologians, most notably Ian Barbour.²

The power structure of the community within which theology is being pursued has also been a contextual influence. The pre-Constantinian Church, marginalised in society and subjected to bouts of persecution, had a different outlook to that of the post-Constantinian Church, enjoying a comfortable alliance with the state. The resulting transformation of spiritual and theological style induced as a consequent counter-movement the emergence of monasticism. Social sensitivities change, as when Christian people came, after eighteen centuries, at last to recognise that the institution of slavery was incompatible with a true concept of the dignity and worth of every human person.

The advance of general human knowledge has also often

2. I. G. Barbour, *Issues in Science and Religion*, SCM Press, 1966; and subsequent writings.

influenced theological judgements. In his *Literal Commentary on Genesis*, Augustine acknowledged that if a traditional interpretation of scripture was found to be untenable in the light of well-established conclusions of secular knowledge, then that interpretation would need to be reconsidered—a dictum to which Galileo was later to make an appeal. In actual fact it has often turned out that matters which had previously been taken for granted by almost all people as being items of common knowledge, such as the fixity of the Earth or the fixity of species, when found scientifically to be in need of revision, were discovered not to be indispensable to theology either. Moreover, it has frequently been the case that Christian thought has been able to benefit from the incorporation of new secular insights. In the nineteenth century, Aubrey Moore, recognising that a theological understanding of evolution implied that God was not a detached and distant Creator, but had chosen to operate through the natural processes by which creatures made themselves, said that Charles Darwin ‘under the guise of a foe, did the work of a friend’.³ This kind of positive interaction should occasion no surprise. Search for knowledge of God is the quest for the most profound and comprehensive form of understanding, a task to which contributions from all truth-seeking enterprises will be both welcome and necessary.

These very general contextual influences have been active in varying degrees in every period of theological thinking. Yet we have noted that the second half of the twentieth century saw a particularly enhanced recognition of explic-

3. Quoted in J. H. Brooke, *Science and Religion*, Cambridge University Press, 1991, p. 314.

itly contextual modes of thought, and a resulting extensive deployment of the resources that they provide. The style of this contemporary contextual theology is largely that which Rowan Williams has called ‘communicative’: making forays into religiously neutral intellectual territory in order to gain new insight through participation in the local culture, while at the same time exploring translations of theological statements into the local dialect.⁴ A portfolio of such theological approaches has been developed, explicitly located within specific domains of experience and insight. As a consequence, one may expect surveys of the contemporary theological scene to include chapters with headings such as ‘Liberation Theology’ (drawing particularly on the experiences and needs of the poor in developing countries), ‘Feminist Theology’ (based on the distinctive perspectives of women, and often severely critical of what is perceived as still being a male-dominated Church and society), or ‘Black Theology’ (drawing on the experiences and insights of black people).⁵ In addition, such surveys are likely to contain chapters overtly related to theological thinking in specific geographical and cultural regions (‘South-East Asian Theology’, ‘African Theology’, and so on). Books of this survey kind will also often have a chapter or two on the relationship between science and theology, but the rubric under which this topic is presented is unlikely to be phrased in contextual terms. I do not think that the title of this book would be a likely chapter heading. This stylistic difference is symptomatic of an underlying unsatisfactoriness in the relationship between science-based understanding and the main-

4. R. Williams, *On Christian Theology*, Blackwell, 2000, p. xiv.

5. For an example, see D. F. Ford and R. Muers (eds), *The Modern Theologians* (3rd edition), Blackwell, 2005.

stream of theological enquiry. There has been a tendency to think of theology's relationship with science simply in terms of wrestling with specific issues and problems, such as creation or divine action, rather than in the general terms that would recognise the scientific context as affording also an opportunity to make use of an intellectual style of thinking of a more widely insightful kind. Of course, specific frontier issues will always be significant foci for interaction, and chapter 5 will look at some of these, but the style of discourse appropriate to the science-and-religion perspective is also something to be accepted and valued in itself.

To put the matter bluntly, I believe that too many theologians fail to treat what science has to offer with the appropriate degree of seriousness that would enable them to acknowledge adequately its contextual role. There are various reasons why this might be the case. One, of course, is an understandable anxiety about getting involved with matters concerning which one does not possess technical mastery. No doubt the details of science often seem opaque and impossibly demanding to those outside it. As a scientist-theologian I can readily understand this feeling, since I face similar problems in my forays into theology, in the course of which I am only too aware of lacking the kind of expertise that can only be gained through a lifetime of scholarly study in a single discipline. The traditional vocabulary of trinitarian theology has its own kind of opacity. Yet if interdisciplinary work is to be undertaken at all, we have to be prepared to accept the intellectual risks involved. Without sticking our necks out a little, we shall not be able to see very far. No one can come to the interdisciplinary task with a range of knowledge so complete that all sense of precariousness can be set aside. Yet, such interdisciplinary inter-

action is essential to the full pursuit of theological enquiry. Since God is the ground of all that is, every kind of human rational investigation of reality must have something to contribute to theological thinking, as the latter pursues its goal of an adequate understanding of the created world, understood in the light of the belief that the mind and purposes of the Creator lie behind cosmic order and history. Every mode of rational exploration of reality will have an offering to make.

As far as interaction with science is concerned, the interdisciplinary task is made more manageable by the fact that it is an engagement with concepts and styles of thought, rather than with highly technical detail, that is required in order to give theologians access to what they really need. Understanding the relevance of general relativity to an adequate account of the nature of created space and time, and its significance in relation to the gravitational properties of matter that have played so important a role in the history of the universe, does not require the theologian to attempt to wrestle with the mathematical intricacies of solutions to Einstein's field equations. There are a number of excellent books for the general educated reader that successfully present scientific concepts in an accessible manner. In addition, there are extensive writings originating in the contemporary science and religion community itself, which offer guides to the exploration of the frontier region between science and theology and provide examples of how people whose intellectual formation has lain in the natural sciences approach questions of religious belief. Yet this substantial body of work is comparatively seldom referred to in any serious way by mainstream theologians. The contrast between this state of affairs and that existing elsewhere between theology and other contextual sources of insight and

experience is striking. Theologians know readily enough that they do not need to have lived in a base community in Latin America in order to be able to avail themselves of the insights and critiques of Liberation Theology. They only need to read with attention the writings of those whose formation has been in that context. Equally, theologians ought to understand that they do not need to have worked in a laboratory, or to be able to read learned scientific journals, in order to be able to avail themselves of the ideas and critiques of the science and religion community. At least some theologians should pay attention to what that community's discourse might have to offer.

One could not deny, however, that some of the responsibility for this neglect lies also with the scientist-theologians themselves. No doubt our amateur writings can lack the depth and sophistication that professional theologians are used to, especially in dealing with such technical subjects as trinitarian theology. No doubt we sometimes display a narrowness of interest. No form of contextual thinking can be free from the limitations intrinsic to its particular perspective. The remedying of such defects has to come from truly interdisciplinary encounter, set up on a wide basis and conducted in a charitable spirit of willingness to learn from the other, not least because of the consciousness of needing one's own view to be enlarged. It is a matter for real regret that, with a few honourable exceptions, mainstream theologians have played only a comparatively minor role in the field of science and religion, seldom participating in conferences or working groups in which the issues have been explored or contributing to the literature.

Another factor that has inhibited interaction between

scientists and theologians has been an ideological disinclination to the task on the part of some members of the theological community. In the twentieth century, the tradition stemming from Karl Barth, arguably the most influential theologian of that period, laid such exclusive stress on the primacy of divine self-revelation in Christ as to seem to relegate to insignificance the role of any investigations that looked at the possibility of collateral illumination offered by other sources of insight or ways of seeking truth. The concept of some degree of general revelation, of the kind associated with the exploration of natural theology in a manner like that pursued by Thomas Aquinas in his discussion of faith and reason, was set aside by many theologians. Yet this is just the kind of approach that can prove fruitful in the exchange between science and theology.

However I have complained enough, and one must also acknowledge that some contemporary theologians have sought to pay attention to what science has to say. One of these is the German Lutheran theologian Wolfhart Pannenberg. He has been emphatic that theology should not confine itself to life in the fideistic ghetto, but it must interact with the whole of human knowledge, including the sciences. Pannenberg has sought a particularly extensive engagement with the human sciences,⁶ but he has also made moves that seek to take the natural sciences into account. It is his belief that:

If the God of the Bible is the creator of the universe, then it is not possible to understand fully or even appropriately the processes of nature without any reference to that God. If, on the contrary, nature can appropriately be understood without reference to the

6. W. Pannenberg, *Anthropology in a Theological Perspective*, Westminster, 1985.

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God of the Bible, then God cannot be the creator of the universe, and consequently he cannot be truly God and be trusted as the source of moral teaching either.⁷

Pannenberg clearly declines the Kantian move of accommodating religion to science by assigning the material world to the latter and allocating the moral sphere to religion. My interpretation of his assertion of the indispensability of the biblical God to the enterprise of science is certainly not that theology has the right to prejudge or intervene in the conclusions reached by science in its own legitimate domain. There is good reason to believe that scientifically posable questions should be expected to receive scientifically stateable answers. But not all significant questions lie within science's self-limited power to answer. Once one moves outside the scientific domain, as we shall see one has to do even when considering such issues as the nature of temporality or the nature of causality, theology has a right to contribute to the subsequent metascientific discourse. In addition, there is a further metascientific necessity to make comprehensible the deep intelligibility of the universe, that fundamental fact about the world which has enabled science to derive its explanatory success.⁸ This is too remarkable a cosmological feature to be treated as if it were just a brute fact or a happy accident. The scientists' discovery of the remarkable transparency of the universe to rational enquiry can be rendered intelligible by the theologian, who is able to interpret it as the consequence of human encounter with the Mind of that world's Creator, the One who is the

7. W. Pannenberg, *Towards a Theology of Nature*, Westminster/John Knox, 1993, p. 16.

8. See, J. C. Polkinghorne, *Faith, Science and Understanding*, SPCK/Yale University Press, 2000, pp. 156-73.

true ground of the wonderful order of the universe. Seen in this way, the activity of science is recognised to be an aspect of the *imago dei*.

Such metascientific questions are certainly important, but they are also very general in their character. Pannenberg has also paid some attention to more specific matters.⁹ One of these concerns the role of the concept of inertia in scientific thinking. A physicist understands inertia to be the property of a body's resistance to having its state of motion changed. At the root of the idea lies Newton's first law of motion, asserting the persistence of uniform motion in a straight line in the absence of an impressed force to effect a change. Pannenberg believes that this purely scientific idea induced the metascientific notion that matter possesses an intrinsic ontological persistence, and that therefore it stands in no need of a creator God to sustain it in being. As a matter of historical fact, the growth of deism and atheism in post-Newtonian Europe may well have owed something to this interpretation, and to the contemporary mechanical philosophy that it encouraged. The twentieth-century demise of mere mechanism gives us a salutary reminder that there is nothing absolute or incorrigible about the context of science. It necessarily shares in the provisionality that must to a degree characterise all human knowledge. Recognition of this fact should make us appropriately cautious, but it should not be allowed to induce rational paralysis. At any given time, human beings have to make the best use of the sources of insight that are at their disposal. In relation to any attempted metascientific appeal to inertia, careful reflection makes it clear that science itself

9. See especially, Pannenberg, *Theology of Nature*.

can neither affirm material existence as a matter of independent metaphysical necessity, as materialism would assert, nor deny theological belief that inertia is a divinely bestowed and sustained property of created matter. These metascientific issues simply lie outside the limited scope of science to settle. The choice between the metaphysical strategies of materialism and theism has to be made on quite different grounds. Pannenberg's anxieties about the influence of inertial ideas are perfectly reasonable, but the remedy is to be sought in the realm of more careful metaphysical assessment.

Another scientific concept that has been treated as highly significant by Pannenberg is the idea of a field. He frequently invokes it as a way of speaking of spirit. Here there are real difficulties. A physicist will feel distinctly uneasy when Pannenberg writes, 'I rather think that the modern conceptions of fields and energy went a long way to "spiritualise" physics'.¹⁰ Many theologians do not seem to understand that Einstein's celebrated equation, $E=mc^2$, can be read both ways. It as much asserts the materiality of energy as it does the energetic character of matter. Fields are carriers of energy and momentum, just like particles. While global in extent, classical fields are local in causal structure (changes in different regions can be made that are independent of each other), and their classical equations are as deterministic as the particle equations of Newtonian mechanics. Quantum fields are certainly indeterministic and inter-relational, but this is because of their quantum nature, not their field character. Much more promising as a possible scientific hint of something akin in nature to spirit is surely to be found in the concept of 'active information',

10. W. Pannenberg in C. R. Albright and J. Haugen (eds), *Beginning with the End*, Open Court, 1997, p. 251.

beginning to emerge from scientific studies of complex systems. This is a point to which we shall return.

A third concept of importance to Pannenberg is contingency. This has two levels of meaning. One is purely meta-scientific, relating to an understanding of the world as ontologically dependent upon its Creator in the manner already briefly alluded to in discussing inertia. The second level concerns the openness of created process to the future, so that cosmic history is seen to have the character of an unfolding exploration, rather than the acting out of an already determined scenario. Here the question of what can be learnt from science about the causal nexus of the world is certainly relevant, even if there must necessarily remain issues which will require metaphysical decision. An honest assessment of well-founded knowledge in this respect shows that the scientific account is cloudy (because of intrinsic unpredictabilities present in both quantum theory and chaos theory) and patchy (because of unresolved perplexities about how different regimes, such as the realm of quantum physics and the realm of classical physics, in fact relate to each other). In characterising the context of science, it is very important to acknowledge that it is not currently able to offer a seamless account of the nature of physical process, interpolating smoothly between the microphysics of the subatomic world, the macrophysics of everyday happenings, and the large-scale processes of cosmic history.¹¹ Certainly, an honest science cannot deny to theology the metaphysical picture of a created universe open towards its future. This is another point to which we shall return.

11. J. C. Polkinghorne, *Exploring Reality*, SPCK/Yale University Press, 2005, ch. 2.

Much more problematic to a scientist, and difficult to sustain, is Pannenberg's strongly expressed 'assumption of the priority of the future over past and present'.¹² The affirmation of the universe as a world of true becoming, which we shall discuss in chapter 3, implies that the future is as yet unformed and therefore the concept of its influence on the present becomes questionable. This is not to deny to God the teleological ability ultimately to bring about determined ends, even if by contingent paths,¹³ but to decline to express this hope in terms of the image of a drawing-power acting from the future. Such talk seems an unnecessary paradoxical inversion of the concept of an unfolding divine purpose at work in creation.

The scientist-theologian will prefer the idea of God's ceaseless providential action, exercised in the moving present and within the open grain of created nature. The fact that quantum physics and thermodynamics both lead naturally to the concept of an arrow of time pointing unambiguously from past to future,¹⁴ reinforces these reservations about laying an emphasis on the priority of the future. To borrow a musical metaphor from Arthur Peacocke, in the context of science cosmic history can best be seen as a great improvised fugue to which Creator and creatures both contribute, without denying that it will finally be brought to a divinely willed Resolution.¹⁵

Pannenberg has clearly made a serious effort to engage

12. Pannenberg, *Anthropology*, p. 520.

13. J. C. Polkinghorne, *The God of Hope and the End of the World*, SPCK/Yale University Press, 2002.

14. Polkinghorne, *Faith, Science and Understanding*, ch. 7.

15. A. R. Peacocke, *Creation and the World of Science*, Oxford University Press, 1979, pp. 105-7.

with modern science. The exercise has mostly been conducted at an elevated conceptual level, without a great deal of attention to the detailed content of science. As a result there has been a degree of conceptual misunderstanding, perhaps partly induced by too great a reliance on seeming verbal parallels involving the use of words such as 'field', which are supposed to encourage analogies that are, in fact, misleading. It is clear that there would have been benefit in conducting the engagement paying more attention to scientific style and content, in the manner that I am calling contextual.

Someone who has sought to look more closely at scientific content has been the Scottish Reformed theologian Thomas Torrance.¹⁶ Yet his chosen heroes and guides, Michael Faraday, James Clerk Maxwell, and Albert Einstein, great scientists though they undoubtedly were, represent the final flowering of classical physics. The advent of modern quantum theory has meant that today we see them as the last of the Ancients rather than as the first of the Moderns. Torrance is eager, as surely all theologians ought to be, to dispel the notion that science's account of the universe is that of a closed and deterministic cosmos. However, he does not find the right way to defend his position. Once again the field concept is wrongly appealed to, as if by itself it relaxed the dead hand of mechanism. We have already seen that this is not the case, because of the deterministic character of classical fields. Ironically, Torrance thought that it was Einstein who found the way out of the deterministic prison, but in fact his whole approach to physics was based on the affirmation of a clear and determinate universe, since he wrongly believed that this was the only way to defend sci-

16. See, Polkinghorne, *Faith, Science and Understanding*, pp. 173–85.

ence's claim to a realistic knowledge of the physical world. In Einstein's thinking, realism was equated with unambiguous objectivity. Hence his well-known and life-long opposition to quantum theory in its modern form. Later we shall see how realism and openness can properly be defended in contemporary science.

Finally we must mention two theologians, the Jesuit Bernard Lonergan¹⁷ and the Anglican Eric Mascall,¹⁸ whose Thomistic thinking encouraged them to look for a positive relationship between faith and reason, theology and science. Both had sufficient mathematical ability to be able to engage with the specificities of physical theory. Their work represents a pioneering attempt at theology conducted in the context of science, in the form in which it could be formulated in the middle of the twentieth century. In the chapters that follow we shall look at the state of that project at the start of the twenty-first century.

17. B. Lonergan, *Insight*, Longman, 1958.

18. E. L. Mascall, *Christian Theology and Natural Science*, Longman, 1956.