THE LIFE AND WORKS OF A BOTTOM-UP THINKER

by John Polkinghorne

Abstract. A brief account is given of the author's life as a physicist and then a priest. The twin foundations of the author's theological endeavors have been a respect for traditional Christian thinking, though not exempting it from revision where this is needed, and a style of argument termed bottom-up thinking, which seeks to proceed from experience to understanding. The diversity of the world faith traditions is perceived as a major source of perplexity. A revised and modest natural theology and the issue of divine action have been at the top of a science and theology agenda. A defense is sketched in realist terms of the metaphysical strategy of using an ontological interpretation of the unpredictabilities of chaos theory to support a notion of top-down causality through active information. The success of Christian theology as a resource of total explanation depends on a credible account of eschatological hope. Reference is made to practical experience of ethics in the public square.

Keywords: bottom-up thinking; chaos theory; divine action; eschatology; natural theology; Nicene Christianity; John Polkinghorne; realism; science and religion; world faiths.

I have always been a Christian believer. I cannot recall a time when I was not a member of the worshipping and believing community of the church. Later in life, I spent five years as a parish priest and three years as a College Dean of Chapel. As a schoolboy I had been good at mathematics, and so, when I went as an undergraduate to Trinity College, Cambridge, it was natural that I studied that subject. I became interested in the way in which one can use mathematics to understand the physical world, and in consequence I did my Ph.D. in theoretical physics, under the supervision of the distinguished Pakistani theorist Abdus Salam. This led to a twenty-five

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year career as a theoretical elementary particle physicist. I had the good fortune to be in that subject in a most interesting period of its development, covering the long series of discoveries that led eventually to what is now called the Standard Model of the quark structure of nuclear matter. I did not make a big discovery myself, but I was an active and productive member of the second division, and I knew all the great scientists who constituted the first division. By the mid 1970s, the dust had settled in this particular branch of physics. I felt that I had done my little bit for the subject and that the time had come to do something else. In 1979 I resigned my Cambridge chair in order to train for the Anglican priesthood. I did not leave physics because I was in any way disillusioned with science; I retain a lively, if no longer technically informed, interest in my old subject. I simply felt that the time had come for a change. A few years into my ordained ministry, I came to the conclusion that a major part of my vocation was to think and write about how science and theology relate to each other. This has been my principal intellectual preoccupation in recent years.

This short biography will make it clear that I am someone who has to take both science and theology with the utmost seriousness. They seem to me to share a common commitment to the search for truth and the desire to find understanding. Although my life changed a lot when I ceased to be a professor and became a priest, there was an important degree of carryover between these two kinds of activity, centering on a common search for motivated belief.

I do a good deal of public speaking about science and religion. (Much of my more popular writing derives from the experience of giving lectures and—the best part—responding to the discussion that follows.) On such occasions I often feel myself to be something of a missionary for science, for I want to encourage those who seek to serve the God of truth to accept with gratitude the insights of scientific truth. I have written four books about science, or the practice of science, intended for the general educated reader. Of these, *The Quantum World* (1984) has been the most successful of all my books in terms of total sales. It is a great privilege to share with other people something of the excitement and wonder that comes with new scientific ideas. In writing of this kind, it is as important to judge correctly what to leave out as what to put in. Some concepts can be made accessible—even some of those associated with the counterintuitive quantum world—but there are others that the reader will just have to take on trust.

I also want to take theology seriously and to share some of its insights with my listeners and readers. Ever since I began my training for the ordained ministry, I have done a great deal of reading in theology. Yet I am conscious that life is too short for most of us to become professional experts in more than one discipline. I was such an expert in theoretical

physics, having served the necessary long apprenticeship, and so I understand what is involved in attaining that status. In my new subject of theology, I do not think that I can claim to be more than a physicist with very serious theological interests. I believe that the latter is the natural status of scientist-theologians like myself and that, in interdisciplinary encounter, we must ask of our theologian colleagues the same degree of charitable encouragement that we wish to extend to them in their forays into science.

My theological thinking is controlled by two broad principles. One is a respect for traditional understanding of Christian truth. For me, the Nicene Creed is the framework within which I choose to locate my theological thinking. Of course, the creed is very spare and unelaborated in its clauses. (I have compared it to the particle data tables that physicists carry in their pockets.) How that skeleton is fleshed out is a matter for each generation to determine for itself as it seeks to make these truths its own in ways that are valid and accessible to it. In our generation, the insights and constraints that science affords in its account of the structure and history of the physical world will be an important resource. Yet I want to use my interpretative freedom in such a way as to maintain, if possible, a trajectory of essential continuity with the understandings of the past.

There are two considerations that persuade me that this is the right strategy. One is that, unlike science, theology is not a cumulative subject. In physics, the average Ph.D. of today understands much more about the universe than even Sir Isaac Newton ever did. In theology, however, we have no reason to assume a presumptive superiority of contemporary theologians over the great theological thinkers and spiritual masters of the past. An interpretation of the faith that appears to imply that it is only in the late twentieth century that we have come to realize what Christianity is really about is to me as suspicious as it is presumptuous. Of course, there will have to be revisions—the Fall is perhaps the most notable example (Polkinghorne 1991, chap. 8; 1998b, 63–65)—but we have to make sure that we do not lose past insights simply because the tenor of our times is inhospitable to them.

The second consideration that attracts me to a Nicene Christianity is that its rich structure and degree of counterintuitiveness give it the kind of character that physicists have found, in their domain, so often to correspond to a successful fundamental theory. It would be unreasonable for a quantum theorist to expect that an account of the mystery of the divine nature would be more plain sailing than that of the subatomic world. The "thickness" of trinitarian and christological theology seems to me to be much more persuasive than a version thinned down to the point of etiolation. In my Gifford Lectures, I set myself the task

> to explore to what extent we can use the search for motivated understanding, so congenial to the scientific mind, as a route to being able to make the substance of Christian orthodoxy our own. Of course, there are some revisions called for in the

process, but I do not find that a trinitarian and incarnational theology needs to be abandoned in favour of a toned-down theology of a Cosmic Mind and an inspired teacher, alleged to be more accessible to the modern mind. A scientist expects a fundamental theory to be tough, surprising and exciting. (Polkinghorne 1994a, 1)

Of course, richness of concept and challenge to common sense no more guarantee the correctness of a theory in theology than they do in physics. Such characteristics may be expected to be necessary conditions for a successful quest for understanding, but they are certainly not sufficient. The way I want to press on with the argument brings me to the second broad principle that controls my theological endeavors. I have called it bottom-up thinking, meaning by that the process of seeking to move from experience to understanding. Scientists know that reality can have many surprises for us and consequently do not hold a high view of human powers of rational prevision. They believe that the question, "Is it reasonable?" is not to be answered in a priori terms but by asking the further question, "What is the evidence that makes you think it might be the case?"

When, as a seminary student at Westcott House, I began the serious study of theology, it was in the lectures in New Testament studies that I felt most at home. Systematic lectures often seemed to me to be characterized by a top-down approach, appealing to general notions whose validity appeared to be taken for granted rather than actually established. In the New Testament courses, however, it seemed to me that we were getting to grips with the phenomena on which Christianity is based, the foundational experiences that led the church, after several centuries of intellectual struggle, to the richness of Nicene theology. Since then, I have tried to read as much New Testament theology as I can, and if a fairy godmother were to offer me a fantasy wish, it would be that at the wave of her wand I would be granted the skills and experience that would turn me into a New Testament theologian. I must acknowledge, however, on the systematic side, the great debt I owe to the writings of Jürgen Moltmann and Wolfhart Pannenberg, which have influenced me greatly. Moltmann's *The Crucified God* (1974) was one of the first serious theological books that I read, and it greatly excited me by exhibiting the power of creative theological thinking.

These two controlling factors, respect for tradition and bottom-up thinking, characterized my Gifford Lectures, which I subtitled "The Theological Reflections of a Bottom-up Thinker." I find myself to be somewhat more traditional than a number of my colleagues in the field of science and theology (see Polkinghorne 1996). Those who disapprove of this stance tend to label me "conservative"; those who approve use the tag "orthodox." I am content to accept both descriptions, if properly construed. My conservatism is not a fearful clinging to the past, but it is rooted in the value to be found there. My orthodoxy arises precisely from believing that this is the right way to think.

As a person who has spent the greater part of his life in the academic community, I always try to write with intellectual seriousness. I have some-

times been described as an apologist for Christianity in a scientific age, and, if that term means someone who seeks to help inquirers to see the reasonableness of religious belief, I would gratefully accept it as an honorable title. However, I strongly believe that an external apologetics will be effective only if it is internally truth-seeking. I have no desire whatsoever to be a polemicist for a cause, even the Christian cause, and I hope that I am honest enough in my writing to acknowledge when I am perplexed and not sure exactly what to say. The problem that most exercises my mind at present is that posed by the diversity of the world faiths (Polkinghorne 1994a, chap. 10). It is rather unnerving for a scientist to contrast this polyglot scene with the single discourse of science. The world religions all bear testimony to the existence and significance of a transcendent dimension of the sacred. Their accounts cannot but be refracted by the varied prisms of the world's cultures. Yet I still find it very perplexing that there is so great a degree of apparent difference in what they have to say.

When I began to write about science and religion, I had to decide for whom I was writing. The choice seemed to lie between the general educated public and the academic community. Of course, it did not involve an absolute dichotomy, but there had to be a principal focus, for the choice would affect the style of presentation. I chose the general educated public. While I always try to write with intellectual care and to be scrupulous about matters of argument and evidence, I do not adopt the kind of heavily footnoted treatment that I know academics like to see. I have to say that I think this has sometimes led people to underestimate my intellectual seriousness. I have occasionally been irritated to read of a comparable treatment of a theme by a colleague being called "more careful," when it has seemed to me simply to be more prolix. I am naturally a very concise writer, and I do not want to waste space on elaboration if it does not further content. I think this is a legacy from my training as a scientist.

I write short books, on the whole, rather than treatises, a fact that I know that some readers, at least, appreciate. I have not been working to a master plan, but I find that from time to time a new topic or problem engages my attention. I then read and think all I can about it, and, after about a year on average, so much is buzzing around in my mind that I find that the only way to sort out what I really think is to try to put it down on paper. (My friend, the late John Robinson, once said to me that he could not think without a pen in his hand. I instantly knew what he meant: the act of writing is the act of the crystallization of thought.) The result is usually a shortish book. By the time that is finished, something else has attracted my attention. My life as a scientist-theologian has had something in common with my career as a theoretical physicist. In both cases, there has been a degree of opportunism involved in selecting something interesting to work on next. Finally, I should say that writing has always been a very pleasurable activity for me.

One of the consequences of my choice to write for the general educated public has been that I have written at a greater variety of levels than is common in the science and theology community. After I had written my Gifford Lectures (1994a) and before I wrote my Terry Lectures (1998a), I allowed myself to write what I think of as my "chatty" book, *Quarks, Chaos and Christianity* (1994b). Many times after a lecture someone had said to me that they would like to read one of my books, and which should it be? Like any author, I am not slow to recommend my own work, but I was conscious that often the inquirer wanted something that was truthful but not too detailed and that gave an overview of the whole field. *Quarks* was my attempt to meet that need (and I am rather fond of it).

An interesting phenomenon in the area of science and theology studies is the way in which authors' scientific experiences influence their writing in the field. All such specific perspectives both confer insight and constrain what is perceivable. My own writing has been strongly influenced by the fact that professionally I am a mathematical physicist who has worked in fundamental physics. Having as an undergraduate sat at the feet of Paul Dirac, that masterful seeker after beautiful equations, I am deeply impressed by the rational order and transparency of the physical world. This has encouraged me to support a revived and revised natural theology (Polkinghorne 1988, chaps. 1 and 2; 1991, chap. 6; 1998a, chap. 1) modest in its ambition in that it claims insight rather than proof, and complementary to science rather than a rival to it, as part of a comprehensive search for understanding. I admit, however, that when we look at the deeply ambiguous story of biological history, natural theology has to give way to a theology of nature (1994a, chap. 2). Here we do not have the possibility of attempting to argue from the world to God, but we must be content to use belief in God as an illuminating interpretative principle, so that evolutionary process is seen as an unfolding act of continuous creation in which that creation is allowed to make itself.

If the idea of continuous creation is to amount to more than a pious gloss on natural happenings, it seems to me that God must be active in the world not only as its upholder and ordainer but also as the God of providence active in cosmic history. One might say that God must be present in the chance as well as in the necessity of an evolving world. The problem of understanding divine action in a way that is consonant with science's accounts of physical and biological process is one that has been at the top of the science and theology agenda in recent years. I have differed from most of my colleagues in the extent to which I have attributed substantial potential significance to an ontological interpretation of the unpredictabilities of chaos theory. For me, the critical realism that many of us both in science and in theology embrace (see Polkinghorne 1991; 1998a, chap. 5) encourages a strategy that I have sought to encapsulate in the slogan "Epistemology models ontology." I mean by this that what we can know and

what we cannot know should be taken as a reliable guide to what is actually the case. The paradigm example is Heisenberg's uncertainty principle (originally an epistemological discovery about what could be measured) being interpreted ontologically by almost all quantum physicists as a principle of indeterminacy. Of course, this is by no means a logically forced move, as David Bohm's alternative interpretation of uncertainty as mere ignorance (see Bohm and Hiley 1993) makes clear.

This is the issue on which I have been most criticized and also most misunderstood. Those who tell me that there can be no entailment from unpredictability to causal openness are simply telling me something that I, and all sensible people, have always known. There is no *deduction* at all from physics to metaphysics, from predictive properties to causal properties of any kind. All metaphysical conjecture is to this extent hazardous. The justification of one's wager, whatever it may be, must lie in its claim to afford enhanced rational explanatory power if adopted. I defend my particular strategy in just these terms, holding that it leads to a concept of top-down causality through *active information* that offers a glimmer of hope for beginning to understand something about the exercise of agency, both human and divine (Polkinghorne 1991, chap. 3; 1995; 1998a, chap. 3). Anyone who speculates about what might be the causal joint by which providential action occurs is open to the further challenge that God has been reduced to the theologically unacceptable status of a cause among causes. I have recently suggested that this charge may not be as damaging as it is traditionally claimed to be, for it may be seen as part of the divine condescension involved in the kenotic creative act of allowing the truly other to be (Polkinghorne 2000, chap. 6).

I must accept some responsibility for the misunderstandings to which I have been subjected in relation to my ideas about divine action. In my first attempt to discuss the issue in *Science and Providence*, I wrote about chaotic systems,

> We are necessarily ignorant about how such systems will behave. If you are a realist and believe, as I believe, that what we know (epistemology) and what is the case (ontology) are closely linked to each other, it is natural to go on to interpret this state of affairs as reflecting an intrinsic openness in the behaviour of these systems. There is an emergent property of flexible process, even within the world of classical physics, which encourages us to see Newton's rigidly deterministic account as no more than an approximation to a more supple reality. (Polkinghorne 1989, 29)

Even for a concise writer like myself, this was far too elliptical and underdeveloped an appeal to the realist strategy outlined above. I have had to spend quite a bit of subsequent effort in elaborating what I was driving at.

Like many of my colleagues, I see the interdisciplinary interaction of science and theology as being part of the noble human quest for understanding. For me, theology as it seeks to speak of God, the ground of all that is, is fulfilling the true role of a Theory of Everything. A theological

view is a total view, based on the claim that at the deepest level the universe makes total sense. One of the biggest challenges such an assertion must face is that posed by the fact of transience and death, on the human scale of tens of years and on the cosmic scale of tens of billions of years. I am convinced that a credible eschatology is essential for a credible Christian theology, and I have been much occupied in recent years in trying to work out a little of what that might involve (Polkinghorne 1994a, chap. 9; Polkinghorne and Welker 2000). The figure of the Cosmic Christ, who reconciles all *things* by the blood of his cross (Colossians 1:20) is of central importance here. So also is the empty tomb, with its message that the Lord's risen body is the glorified and transmuted form of his dead body, thereby testifying to the fact that in Christ there is hope for matter as well as people. Mysterious and difficult as these ideas may be, I believe that they are essential for the integrity of the Christian hope.

In conclusion, I would like to refer briefly to an aspect of my life that arose unexpectedly in 1988 when I was asked to chair a British Government committee charged with revising the code of practice for the use of fetal material in research and therapy in my country. With the aid of my capable colleagues, we produced the code that is still in force in Britain. This experience led to further service, often in the chair, on other official committees concerned with issues such as genetically modified food, the treatment of drug misusers, and issues in human genetics. My involvement in this way with ethical questions has been amateur and practical in its character. It has been reflected in only a small amount of published work, in the form of a few articles that have appeared in journals and books concerned with bioethics.

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