WOLFHART PANNENBERG'S ENGAGEMENT WITH THE NATURAL SCIENCES

by John Polkinghorne

Abstract. Wolfhart Pannenberg's engagement with the natural sciences is surveyed. A critique is given of his treatment of these themes: the concept of a field; contingency; the role of the future.

Keywords: contingency; field; metaquestions; Wolfhart Pannenberg; role of the future; Frank Tipler.

The thought of Wolfhart Pannenberg is of particular interest to those of us whose intellectual formation lay in the natural sciences. There are a number of reasons why this should be so. One is Pannenberg's open approach to theology, acknowledging the possibility of its being in need of correction and allowing an appeal to evidence as the ground for motivated belief, not least in relation to the resurrection of Christ. This suggests the existence of a degree of intellectual kinship between theology and science. Another reason, of a most direct kind to catch the attention of scientists, is that Pannenberg himself expresses a serious concern with what the natural sciences have to say. Not for him the life of the theological ghetto, which some of his fellow practitioners seem to occupy, in which a special language is spoken, allowing no discourse with those tongues whose utterance lies outside that closed world.

Pannenberg's writings are voluminous and demanding. It is therefore a great benefit that there is a single book (Albright and Haugen 1997) in which some of his essays of particular relevance to science are gathered together; his thought is discussed by a variety of scientists, philosophers and theologians; and he himself responds at the end to this vigorous debate. In the book, Carol Rausch Albright provides a series of clear and sure-footed introductory prefaces to the successive sections into which the

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material is organized, a guide to the labyrinth that will be appreciated by many readers.

The foundation of Pannenberg's thinking is his belief in God as the all-determining reality. There is no realm of human enquiry or area of human experience from which God is excluded or which can be fully intelligible without taking into account the divine will and purpose that undergirds it. Here is the modern formulation of the scholastic concept of theology as the queen of the sciences, understanding "science" in the medieval sense of *scientia*, all knowledge. Theology's regal status, according to this concept, derives from its access to the deepest and most comprehensive ground of intelligibility rather than from a presumed prescriptive right to tell the other individual sciences what to think at the level of their first-order enquiries. The critical question here is one of *scope*. Other particular sciences pursue a limited range of enquiry; theology is unlimited in the width of its considerations, for it is "not concerned with this or that being in its particularity, or with one area of reality which can be separated from others [but] with reality in general" (Pannenberg 1976, 303).

In relation to the natural sciences, this leads Pannenberg to write the following:

> 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 be appropriately understood without reference to the God of the Bible, then that God cannot be the creator of the universe, and consequently he cannot be truly God and be trusted as a source of moral teaching either. (Quoted in Albright and Haugen 1997, 38)

The last remark is clearly intended as a refutation of the Kantian program that allocated the physical world to science and the moral sphere to religion. Some care would be needed in evaluating what such a claim about the processes of nature could actually amount to.

The manifest success of a *methodologically* atheistic natural science, often pursued with great insight by people of no religious belief, shows that it would be implausible to suggest too direct an influence of theology upon the researches of science. Moreover, such a claim of the relative independence of the natural sciences could find a degree of theological support. An important aspect of much twentieth-century theological thinking about the doctrine of Creation has been an emphasis on the kenotic character of the Creator's act. A letting-be by divine love of the truly other, allowed by God to be itself, carries with it the implication of a degree of due independence granted to creatures. We may understand this as being the theological source of science's ability to pursue its investigations *etsi deus non daretur*, as if God did not exist.

Where theological understanding does come in to augment and complement scientific understanding is in relation to certain limit questions that

arise out of scientific experience but that transcend science's own self-limited range of enquiry. They center around two fundamental metaquestions:

1. Why is the universe so deeply intelligible? Putting it more bluntly, why is science possible? Our ability to understand the physical world vastly exceeds anything that could plausibly be held to correspond to evolutionary necessity or to be a happy accidental spin-off from survival requirements. Science exploits the wonderful rational transparency of the physical world, but it does not explain it. If the universe is the creation of the rational God, then it is possible to understand its intelligibility as due to its being shot through with signs of the mind of its Creator, signs that are accessible to the thoughts of creatures made in the image of the Creator.

2. Why is the universe so special? This question arises from the recognition, enshrined in the Anthropic Principle, that the laws of nature are fine-tuned to the high degree of specificity found to be necessary to make the evolution of carbon-based life a possibility. A variety of responses is possible to the issues raised here. Theism is not the only conceivable answer, but it is one that is coherent, economic, and intellectually satisfying.

There are also further theological insights that complement understandings drawn from science but that correspond to a theology of nature rather than a natural theology. The latter frames its arguments in terms of rumors of God derived "from below," appealing to the intelligibility and fruitfulness of the world, in contrast to the former's insights derived "from above," appealing to the concept of the Creator to provide greater understanding of the processes of that world. A prime example would be the interpretation of an evolutionary universe not as the meaningless empire of accident proclaimed by atheist biologists such as Jacques Monod and Richard Dawkins but as a creation allowed by God to explore and realize the potentiality with which it has been endowed—in short, "to make itself."

Pannenberg's actual engagement with the natural sciences has not been in such specific terms as are involved either in the discussion of natural theology or of a theology of nature. He has certainly conducted a detailed dialogue with the human sciences (Pannenberg 1985), an interface with theology which is obviously of the highest significance for both disciplines. Yet, in contrast, his intercourse with the physical and biological sciences has been conducted in very general terms. It has centered around three broad topics, each characteristic also of Pannenberg's wider theological concerns: the concept of field, contingency, and the future.

The Concept of Field

This is perhaps the most baffling aspect of Pannenberg's thought for the scientist to confront. His writings abound with references to fields as expressions of divine presence and as significant entities in other ways as

well. The first problem is how seriously the language should be taken. If the word *field* is just being used in a nonspecific sense to signify something involving the notion of extended relationality, then the scientist can have nothing to quarrel with except to express regret that a word with a precise meaning in physics is being employed in this rather vague way. However, this does not seem to be all that is going on. References to Michael Faraday (but not many references to the enormous development of the field concept that followed in physics during the next one hundred fifty years) seem to suggest a more focused appeal to scientific parallels.

We are told that by *field* Pannenberg means "the interpenetrating network of energetic forces which are woven into relational patterns" (Albright and Haugen 1997, 213). Note the word *energetic*, which seems to point clearly in the direction of physics. It is important to recognize that energy is not a kind of *spiritual* concept. Einstein's famous equation, $E=mc^2$, asserts the materiality of energy as much as it does the energetic character of matter. A physical field, such as Maxwell's electromagnetic field, carries energy and momentum, inertial properties that function in the same way for the field as they do for particles of matter. Pannenberg does not seem to recognize that this is so. After a long historical discussion of the word *spirit*, noting among other things the Stoic notion of *pneuma* as subtle matter, he feels that we have progressed beyond a kind of etiolated materialism, for "difficulties of this kind no longer burden the field concept of modern physics, at least if no ether is considered necessary for the expansion of waves within the field" (Pannenberg 1993, 81). This notion of a field's immateriality clearly is not correct. The physicist cannot be other than profoundly uneasy when Pannenberg writes, "I rather think that the modern conception of fields and energy went a long way to 'spiritualise' physics" (Albright and Haugen 1997, 429).

If there is a hint of a move in modern physics in the direction that Pannenberg desires, it does not arise from field theory but from developments in chaos theory and complexity theory. The discovery of the spontaneous generation of large-scale orderly structures in complex systems, extended both in space and in time, has led to a recognition that notions of energetic causality need supplementing by notions of a kind of pattern-forming causality, for which some of us have coined the term "active information" (Peacocke 1993, chaps. 3 and 9; Polkinghorne 1991, chap. 3, and 1998, chap. 3). If there is a hint of the emergence of the "spiritual" in modern science, this is where it is to be found and not in field theory as such. The behavior of these complex physical systems also manifests irreversibility (the distinction between past and future, defining a direction for the arrow of time). This is a property to which Pannenberg attaches great significance, because of his emphasis on the role of a genuinely unfolding history of creation.

The same set of scientific discoveries also encourages the recognition of

the need to think holistically as well as in constituent terms. Chaotic systems are so sensitive to circumstances that they can never be treated in isolation from their environment. Spontaneously generated order appears as a property of the whole. Even quantum theory is found to bear witness to the non-atomistic nature of physical reality by its discovery of the "EPR effect," a counterintuitive "togetherness-in-separation" (non-locality) enjoyed by two quantum systems once they have interacted with each other, however far apart they may subsequently separate. The holistic view of the significance of wholes over parts, to which Pannenberg rightly attaches great importance, derives, as far as natural science is concerned, largely from our growing insight into the way in which complexity generates emergent novelty and not from field theory. In fact, contrary to what Pannenberg appears to believe, a classical field is a *local* entity. It is indeed spread out over the whole of space, but its values can be varied independently at points that are spatially separated from each other. They are not tied together into an integrated whole.

Where modern field theory does express a kind of integrated synthesis is in its "quantized" form. Quantum field theory resolves the paradox of wave/particle duality. All fields have wavelike properties because of their spatial extension, but the addition of quantum mechanics introduces also a countable discreteness. The energetic excitations of the field then come in packets (quanta), which are given a particle interpretation. In modern physical thinking, particles and fields belong together as a single entity, the former being excitations in the latter. In the powerful concept pioneered by Richard Feynman, the interactions of fields are conveyed by the exchange of virtual particles corresponding to them.

It is not the case that fields as such have any intrinsic relationship to contingency. The difference classically between a collection of particles and a field is simply that the former has a finite number of degrees of freedom (distinct ways in which its state of motion can change) and the latter has an infinite number of degrees of freedom. This results in particles being described by ordinary differential equations and fields by partial differential equations. Both sets of equations are equally deterministic; correctly set boundary conditions specify completely the subsequent temporal development of their solutions. Of course, quantum fields do display contingent behavior, but that arises from their quantum mechanical, rather than their field theoretic, nature.

Contingency

Pannenberg places great emphasis on the contingency of creation. This is understood in two distinct senses. One affirms the total dependence of the universe upon its Creator, who freely holds it in being, moment by moment. The other relates to the reality and significance of history, which

is no mere unrolling of an already written scroll but the unfolding development of a world of true becoming. Both concepts are fundamental to Christian theology, and Pannenberg's strong defense of them is very welcome. He believes that they were threatened by the development of the scientific idea of inertia, adumbrated in the later Middle Ages, articulated by Galileo and Newton, and expressed in modern physics by the conservation laws (of energy, momentum, angular momentum, and so on), which play so important a role in the contemporary understanding of nature. Pannenberg defines inertia as "an innate potential of persistence for any physical entity, be it in a state of rest or in a state of motion, unless it is disturbed by some other force" (Albright and Haugen 1997, 41). He believes the notion has exercised a pernicious influence on theology. In his view, it led to the idea of the self-sustaining character of matter and so encouraged a line of thought leading to the redundancy of the Creator. While historically this may well have been the case, it is clear that there was never a theological necessity that this should be so. Conservation laws are as contingent as any other part of the laws of nature. Theologically they are understood to continue only as long as the Creator sustains them in being. This aspect of contingency is radically metaphysical in character, so it can be neither asserted nor denied simply on the basis of any form of physical theory.

The second sense of contingency, relating to the character of physical process, is also metaphysical in nature but in a way that is more open to influence from physics. It must be admitted that the openness of the future would be hard to defend in the rigidly deterministic universe that Laplace regarded as the inexorable consequence of taking Newtonian ideas seriously. In that world, full knowledge of the present, together with unlimited calculating power, implied also total knowledge of a rigorously entailed past and future. Nothing really novel ever happened; history was a reiterated tautology. The iron grip of Laplace's calculating demon has been relaxed, however, by the twentieth-century discovery of widespread *intrinsic* unpredictabilities present in nature, both at the microscopic level of quantum events and also at the macroscopic level of the behavior of exquisitely sensitive chaotic systems. Whether these epistemological deficiencies are to be interpreted as signs of an ontological openness is a metaphysical question, not to be settled by the natural sciences alone. In the case of quantum theory, the vast majority of physicists have chosen the ontological option, although the existence of David Bohm's alternative deterministic interpretation shows that this is not a forced move (Bohm and Hiley 1993). If openness is the selected metaphysical decision, it carries with it the implication that there must be additional causal principles, beyond the energetic exchanges between constituents (the proper domain of physical concern), which play their part in bringing about the actual future. In the case of quantum theory, it is commonly assumed that the

extra principle is simply radical randomness of outcome. In the case of chaotic systems, it is possible to develop an interpretation that leads to identifying the extra causal principles with forms of the "active information" already discussed. Such a program would then achieve Pannenberg's desired defense of the openness of history, as theology wishes to understand it, by appeal not to field theory but to the ideas of the top-down effects of active information. There is much that is necessarily speculative here, but I believe that these ideas afford a better model than field for the presence and activity of the Spirit. The emphasis on pattern making certainly seems consistent with Pannenberg's idea of Spirit as a "presence of meaning" (1985, 520).

The Future

Perhaps the most distinctive aspect of Pannenberg's thinking has been his emphasis on the role of the future, conceived not simply as the location of the fulfillment of divine purpose at the end of history but as the locus of a retrospective drawing power, guiding history in the direction that God wills for it: "it is from the future that the abiding essence of things discloses itself" (Pannenberg 1985, 525).

Oddly enough, there is a rather banal way in which science could accommodate this notion. It is well known that the field equations of physics admit of two mutually exclusive forms of solution. One, based on what are called retarded potentials, describes a situation in which effects propagate from past to future; the other, based on advanced potentials, describes a situation in which effects propagate from the future into the past. However, it is a physical fact (whose origin is not well understood) that our universe appears to be one whose processes are generated by retarded potentials only. In our world the bell rings only after the button has been pressed.

Among the dangers in venturing into a discipline beyond one's own is that of succumbing to gullibility. Scientists who make forays into theology are by no means exempt from this peril. Nor is Pannenberg in his engagement with physical science. This is most evident in the enthusiastic welcome he gave to the speculative ideas of Frank Tipler (1994). Pannenberg is certainly not without his reservations (Albright and Haugen 1997, 437–41), but in general he takes Tipler much more seriously than, say, the scientist-theologians are inclined to do (Polkinghorne 1996, 53). There is in Tipler's work a chilling reductionism (human beings are regarded as information-processing finite state machines), and its character is fantastically speculative, not only metaphysically but also scientifically.

The themes of this essay have been rather critical of details of Pannenberg's engagement with the natural sciences. It is to be hoped that the reader will perceive beneath these themes the *cantus firmus* of an admiration for a

great theologian who is not content to dwell in a theological ghetto but who ventures forth for dialogue with many branches of human enquiry, sustained by his conviction of the unity of knowledge, a conviction that is underwritten by the oneness of the Creator, understood as the all-determining reality.

References

Albright, Carol Rausch, and Joel Haugen, eds. 1997. *Beginning with the End: God, Science, and Wolfhart Pannenberg.* Chicago: Open Court.
Bohm, David, and Basil Hiley. 1993. *The Undivided Universe*. London: Routledge.
Pannenberg, Wolfhart. 1976. *Theology and the Philosophy of Science*. London: Darton, Longman, and Todd.
———. 1993. *Towards a Theology of Nature* (ed. Ted Peters). Louisville: Westminster/ John Knox.
———. 1985. *Anthropology in Theological Perspective.* Philadelphia: Westminster.
Peacocke, Arthur. 1993. *Theology for a Scientific Age*. London: SCM Press.
Polkinghorne, John. 1991. *Reason and Reality.* London: SPCK.
———. 1996. *Scientists as Theologians.* London: SPCK.
———. 1998. *Belief in God in an Age of Science.* New Haven, Conn.: Yale Univ. Press.
Tipler, Frank. 1994. *The Physics of Immortality*. London: Macmillan.