

THE DOCTRINE OF CREATION AND MODERN SCIENCE

by Wolfhart Pannenberg

Abstract. In contrast to Christian theology that has ignored science, this essay suggests that a credible doctrine of God as creator must take into account scientific understandings of the world. The introduction of the principle of inertia into seventeenth-century science and philosophy helped change the traditional idea of God as creator (which included divine conservation and governance) into a deist concept of God. To recapture the idea that God continually creates, it is important to affirm the contingency of the world as a whole and of all events in the world. Reflecting on the interrelationship of contingency and natural law provides a framework for relating scientific theories of a universal field, the concept of emergent evolution, and the theological concept of eternal divine spirit active in all creation.

Keywords: contingency; creation; emergent evolution; field theory; God; spirit of God.

From the eighteenth century to the beginning of the twentieth century the relations between science and Christian theology were marked by increasing mutual alienation. In the course of this century, however, there has emerged a series of efforts to bridge the gulf that had developed. In England these efforts started as early as the second half of the last century when there was an attempt to make a theologically positive evaluation of the doctrine of evolution in order to integrate it into a Christian vision of the world and of salvation-history. A considerable number of scientists, especially biologists, took part in these efforts, particularly in Great Britain and in America.

German thinkers did not really participate in these efforts, although in the beginning of this century the remarkable Erlangen theologian

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[*Zygon*, vol. 23, no. 1 (March 1988).] ISSN 0591-2385

Karl Beth did develop a similar approach in apologetics. Unfortunately, Beth has been largely forgotten. Instead, the initiative to dialogue came from a number of leading physicists, beginning with Max Planck, but it did not take actual shape until the early postwar period. The dialogue was more difficult in Germany because the concept of evolution was not used as a common denominator for both scientific and theological views.

Even to this day the history of the alienation between the natural sciences and theology has not been resolved. The systematic discussion of those substantial issues that resulted in the process of mutual alienation has rarely begun. Part of the explanation of this failure may be the fact that not until the last six decades has the discipline of the history of science provided results which make it possible to deal with these problems on the basis of sufficient information and a methodical procedure. The contributions of Max Jammer and Alexandre Koyre, of Mary Hesse and William Berkson are particularly helpful examples.

The reasons for the history of alienation between science and theology can be found on both sides. As modern science began there was the fatal lack of appreciation of the new doctrine of Copernicus by theology and church, not only by Catholics but also by Protestants. Both Martin Luther and Philipp Melanchthon failed to realize the importance of Copernicus because of their reliance on the literal authority of the Bible. In one of his "Table Talks" in 1539 Luther said he would rather believe Holy Scripture which reports in the book of Joshua (10:12-14) that Joshua ordered the sun to stand still and not the earth (Luther 1912-21, vol. 4, no. 4638). This biblical fundamentalism and the resulting suspicion against the new astronomy continued in German Lutheran theology until the early eighteenth century. In the period of the Enlightenment theologians tried to adapt the biblical seven-days-scheme of creation to the new scientific picture of the natural world. However, in the meantime other and even more fundamental problems had surfaced.

These problems emerged from drawing out the implications of the new mechanical physics for understanding the basic relationship between God and world. Of special importance was the introduction of the principle of inertia. Already in the thought of René Descartes, this principle led to an emancipation of natural processes from their dependence on God although the general framework of Descartes' ideas concerning the creation of the world and its need for continuous preservation by God was still quite traditional. Descartes' formulation of the principle of inertia stated that each part of natural matter tends to preserve its status as long as this is not changed by external factors. Such changes, however, can be initiated only by other parts of natural

matter, that is, by other bodies. The reason for this assumption was Descartes' concept of God. On the one hand he still considered it necessary to give a reason for the principle of inertia itself. Descartes did not yet take inertia simply as manifestation of a *vis insita*, a force of perseverance within the body itself, as Isaac Newton did later. Rather, Descartes took it to manifest the immutability of God, who—as far as he is concerned—preserves his creature in the same form in which he created it. The same principle of divine immutability, on the other hand, prevented Descartes from ascribing to God the changes that occur in the world of creation. All changes, therefore, had to be interpreted as resulting from the actions of other bodies, the presupposition of this being that bodies always are in some form of movement which they transfer to each other by pressure and push. When the assumption that movement is intrinsic to the bodies themselves was combined with the principle of inertia, the need for the cooperation of God as first cause became superfluous in the explanation of natural processes.

Baruch Spinoza explicitly drew that consequence of the mechanical explanation of nature, and he protected it against theological suspicion by the argument that the independent functioning of the world's mechanism gives expression to the perfection of its divine author and of his work. In the early eighteenth century Protestant theologians realized the danger, however, that in this way God would be separated from his creation. J. F. Buddeus argued that in the final analysis this amounts to a denial of God's very existence because God becomes superfluous.

The same reason induced Newton to reject Descartes' reduction of movement to the concept of body and to replace it by his conception of force as *vis impressa*, as a force that may impress movements upon bodies even over great distances in space. However, Newton's general conception of force was not successful, at least not in the judgment of his own age. Instead, the combination of Newton's interpretation of inertia in terms of a force that is inherent in bodies with the reduction of force to a body and its mass contributed in a decisive way in the course of the eighteenth century to the removal of God from the explanation of nature.

German Protestant theology since the early nineteenth century developed an attitude of resignation in facing this development. It is important to understand that there were theological reasons behind the formation of this attitude. The rapid development of historical-critical investigation of biblical writings had dissolved the traditional understanding of the authority of the Bible based upon the divine inspiration of its wording. The biblical authors' conceptions of the

order of nature came to be interpreted as an expression of a primitive understanding of natural order, as an expression of some archaic, mythical conception of the world, or even as an expression of cultic life as found in the biblical seven-days-scheme of creation. Therefore, as early as 1814 even a traditional theologian like Karl Gottlieb Bretschneider considered it "a lost effort to try a physical demonstration of the words of creation as reported by Moses" (Bretschneider 1828, 587). After that time theological apologetics increasingly abstained from theological interpretation of criticism of the foundations of natural science and embarked on the unhappy strategy of looking for gaps in the scientific explanation of nature.

It was largely due to this strategy that Charles Darwin's theory of evolution could be perceived in Germany as not being a fundamental challenge to faith in God. When the theory of evolution prevailed in the scientific world, many theologians in Germany withdrew to a position claiming an incomparability of the theological and the scientific description of the world. This was quite contrary to the situation in England and in America where an early breakthrough to a positive interpretation of natural evolution took place. The most remarkable example of the theological retreat from a discussion of the scientific description of nature can be found in the writings of Karl Barth. In the preface of his doctrine of creation, *Church Dogmatics*, Barth decided that in principle a theological doctrine of creation should not concern itself with scientific descriptions and results (Barth 1936-62, 3/1: preface).

One may look to the work of Karl Heim as an example of a different attitude in German theology. Yet for all his competence in conversations with scientists, Heim was more concerned to relativize the level of scientific conceptualizing and description of nature entirely by presenting it as a form of thought over against which theology represents a quite different form of thought—not "polarized" but, as Heim said, "super-polar." Therefore, even Heim did not actually enter into a theological appropriation and critique of the conceptual foundations of natural science. In order to do this he needed a clear perception of the interrelations between the history of philosophy and the history of the formation of scientific conceptuality; in this area he did not employ the necessary information. Still in contrast to Barth, Heim was aware of the fact that theological talk about God as creator (and, therefore, any talk about God) remains empty if it cannot be related to a scientific description of nature.

In the modern world scientific theories have achieved such a high degree of common recognition of validity that in public consciousness the primary if not exclusive competence for valid assertions about the

reality of the world is attributed to the sciences. It is impossible to change this fact by mere decree. If theologians want to conceive of God as the creator of the real world, they cannot possibly bypass the scientific description of that world. Certainly, theological assertions concerning the world are not formulated on the same level as scientific hypotheses of natural law; however, they have to be related to scientific reasoning. Whether this is possible or not must be discussed at the level of philosophical (or maybe theological) reflection on the assertions of the natural sciences. Of course it is possible to suspect that such reflection may remain something secondary and arbitrary in comparison to the scientific statements themselves. Philosophical or theological reflection on science may be considered a form of thought that remains irrelevant on the level of the demonstration and validity of scientific hypothesis and theories. Positivistic philosophy of science used to describe the situation in such a way.

Research in the history of science now has suggested a different perspective. In contrast to other positivists Karl Popper even in his early years admitted that metaphysical convictions of innovative scientists might belong to the subjective factors conditioning the formation of their scientific hypotheses and theories. Yet his one-time student William Berkson uses the history of field physics to show that certain metaphysical conceptions not only have individual importance but accompany or even guide the development of entire branches of natural science. If this is so, the philosophical origin of scientific conceptuality can no longer be regarded as something external and irrelevant as far as the scientific theories themselves are concerned. Certainly, the demonstration of the scientific usefulness of such conceptualities and of their use in scientific formulas has to operate on a different level, that of the particular science, but even so they remain dependent on the broader philosophical intuition from which they were derived. The interrelation of scientific and philosophical conceptuality determines the framework for a rational discussion of the question: Are the theological assertions about the world as creation relatable to the scientific description of the natural world?

The remainder of this paper intends to suggest how the subject matter of the theological doctrine of creation implies that it is possible to appropriate the scientific description of the world of nature in the way just indicated. It is not my intention to discuss the claims of an alternative "creationist" science. I do not think that the creationists are really in a position to challenge the established theories of modern science. Theology has to relate to the science there *is* rather than invent a different form of science for its own use.

CREATION AND CONTINGENCY

The traditional doctrine of creation distinguishes between creation as an act of God and creatures as the products of divine activity. In dealing with creation as an act of God the correspondence between creation, conservation, and the divine government of the world was discussed along with questions such as the meaning of the participation of Christ or the divine logos and of the Holy Spirit in the work of creation. The theological treatment of the different creatures is traditionally concerned with the order of creation in the sequence of the divine production following more or less the biblical presentation of the work of creation taking place in a sequence of seven days. The attribution of certain creatures to a certain "day" of creation has been the dominant form in theological tradition of conceiving of an order of nature.

Obviously there are connections—not only correspondences but also differences—between the traditional theological account of the formation of the world and the scientific description of nature, especially concerning the description of the different creatures and the sequence of their appearance or emergence. There are also such connections already with the theological doctrines of creation, conservation, and government; and these raise fundamental questions regarding our understanding of the world. Therefore, the following considerations focus primarily on these issues.

First, the theological affirmation that the world of nature proceeds from an act of divine creation implies the claim that the existence of the world as a whole and of all its parts is contingent. The existence of the whole world is contingent in the sense that it need not exist at all. It owes its being to the free activity of divine creation. So does every part of the world. In addition, there is a close connection between this contingency and the structure of time insofar as the possibility of existence is tied to the future. The structural modes of reality are rooted in temporality.

Affirmations concerning the contingency of the world at large and of all its parts already imply a close connection between creation and conservation. The world was not just placed into existence once, at the beginning of all things, in such a way that it would have been left on its own afterwards. Rather, every creature is in need of conservation of its existence in every moment, and according to theological tradition such conservation is nothing else but a continuous creation. This means that the act of creation did not only take place in the beginning; it occurs at every moment. Accordingly, in the traditional theological doctrine of creation the activity of every creature is dependent upon divine cooperation, a *concursum divinum*. There is no activity and no product of creative activity in the world without divine cooperation.

While each single event or act in the world by itself is immediate and contingent, the divine activity cooperates with the activity of the creatures and forms a continuity of action. This continuity has been identified in the theological tradition with the idea of divine governance of the world. It is due to this divine government of creation that the sequence of contingent events and created forms take the shape of a continuous process toward the divine goal of an ultimate completion and glorification of all creation.

The three aspects of conservation, concurrence, and government have been often formulated together into the concept of divine providence. The difference, however, between the act of creation in the beginning and the activity of divine providence in the course of an already existing world, as well as further subdistinctions of the concept of providence itself, must not obscure the unity of divine action in all these respects.

This entire conception of God's creative activity was greatly challenged in the seventeenth century with the introduction of the principle of inertia. The German philosopher Hans Blumenberg has repeatedly highlighted this remarkable event, an event of far-reaching importance in the history of modern times (Blumenberg 1983). The principle of inertia as formulated by Descartes means that the continuous existence of any given state of affairs is no longer in need of explanation; only the occurrence of any changes of this status require justification. This principle does not yet abolish the notion of a creation in the beginning, but a continuous conservation of what once was created becomes unnecessary. This consequence seems to be inevitable if inertia, in contrast to Descartes, is understood as a force of self-preservation inherent in the body, a *vis insita*. On this basis, a conservation of nature by some transcendent cause indeed becomes superfluous. In a similar way the mechanical interpretation of the changes occurring to the bodies in terms of a transfer of movement renders the assumption of a divine cooperation in the activities of the creatures superfluous. Thus, deism must be seen as the consequence of the introduction of the principle of inertia into modern physics.

In view of the historical importance of this development, any contemporary discussion regarding theology and science should first focus on the question of what modern science, especially modern physics, can say about the contingency of the universe as a whole and of every part in it. This is, of course, a more general formulation of the basic issue inherent in the affirmations of the dependence of the natural world upon its creation and conservation by God.

A discussion of this question of contingency in natural science took place during the 1960s at the Protestant Academy of Research at

Heidelberg. The subject was treated by reflecting upon the character, range, and limits of scientific language and especially on the correlation of law and contingency. As a result of this discussion, an agreement was formulated to the effect that each scientific hypothesis of law describes uniformities in the behavior of the object of such hypotheses. The object itself, however, is contingently given in relation to its hypothetical description where the affirmed law obtains. This element of contingency in the givenness of the object, however, is usually not explicitly focused upon in scientific statements. The focus is rather on the uniformities that can be expressed in equations. It is accepted as matter of fact that those uniformities occur in a substratum that is not exhausted by them.

After some reflection, however, the applicability of scientific formulas to concrete cases of natural processes requires initial and marginal conditions which are contingent in relation to the uniformity affirmed in the equation. Also, the natural constants that become part of the equation must be considered as contingent factors. This means that the description of nature by hypothetical statements of natural law presuppose their material as contingently given. These statements do not focus on this contingency, however, because their intention is the formulation of uniformities that occur in the natural phenomena, their contingency notwithstanding. This focusing on the aspect of law constitutes the specifically abstract character of a scientific description of natural processes.

If this consideration is correct, it yields far-reaching consequences: the scientific affirmations of law cannot be considered as complete and exhaustive descriptions of the natural processes. They are only approximations although they may be more than sufficiently precise for most practical purposes. The connection between events admits, however, another form of description which does not focus on uniformities in abstraction from the unique and contingent sequence of singular events. Rather, it describes that kind of connection which is to be constituted in the course of the contingent sequence itself and which can be perceived, therefore, only at the end of the sequence in question. In the perspective of such a description the sequence of events is not considered as exchangeable cases where a common formula of law applies according to the scheme "if A, then B." Rather, the sequence is here perceived as a historical sequence, as a unique and irreversible process.

The two descriptions do not necessarily relate to different kinds of processes. The same process admits the description of cases of general laws as well as the description of individual, historical sequences. The description of a sequence of events as a historical process may be less

abstract than its scientific description, and it presupposes more information about the individual sequence and its phases. On the other hand, the description of the same sequence as a case of general law presupposes a knowledge of other comparable processes.

In Christian theological discourse—in distinction from scientific descriptions, with the possible exception of the discipline of natural history—the sequence of events is taken as a historical sequence. The preference of Christian theology for historical presentation of reality is related to its interest in the contingency of natural events. This does not necessarily mean that theology should treat everything in a narrative form. Rather, much analytic and constructive reflection is necessary before the theologian can hope to tell the story of God with the creation with any degree of plausibility. Even historical narration presupposes a prior reconstruction of the process the historian reports.

The particularity of theology in looking at the world as history also applies to the uniformities that occur in the course of natural processes and to the enduring forms of natural reality that emerge from the basis of such uniformities. In the theological perspective such uniformities, a substratum of the hypothesis of natural law, as well as the enduring forms of natural reality are considered to be contingent in the same way as any single event is considered. The laws of nature appear to the theologian as contingent products of the creative freedom of God. The unity of contingency and continuity in the creative activity of God as well as in its products is rooted, according to a theological interpretation of the world, in God's faithfulness. Although his action is contingent and underivable in each singular moment, still it keeps a connection to what happened before, although even the future form of manifestation of God's faithfulness remains unforeseeable.

FIELD AND SPIRIT

The reflections on the interrelation of contingency and natural law provide only a very abstract and formal framework for the interpretation of scientific and theological statements about the world of nature. These considerations do not yet relate to the specific subject of natural science. If one remembers the history of modern science, it is obvious that its theories first have been related to describing the movements and changes in natural phenomena. For this purpose modern physics developed the concepts of force and energy which act upon bodies and produce changes within them. By introducing the concept of force Newton modified Descartes' interpretation of the changes in natural bodies as a result of movement. On the one hand, this modification broadened the concept of mass so that the product of mass and acceleration now allows for the measurement of force; but, on the other hand

and above all, the basic concept of force itself took the general form of *vis impressa*. In contrast to Descartes, Newton took into account the possibility of immaterial forces that act in a way analogous to the activity of the soul upon the body. He took gravitation as an example of such a force and considered it as an expression of the immaterial activity of God moving the universe by means of space (Koyre [1957] 1969, 163-64). Apparently it was precisely these theological implications of Newton's conception of immaterial forces causing material changes which provoked the criticism of his idea of force through the eighteenth century and further until the work of Ernst Mach and Heinrich Hertz, as Max Jammer suggested. The tendency of a certain line of development in modern physics to reduce all forces to bodies or "masses" (Hertz) had anti-theological implications: If all forces would proceed from bodies or masses, then the understanding of nature would be so thoroughly separated from the idea of God—who is not a body—that theological language about a divine activity in the processes of the natural world would become simply unintelligible and absurd.

In contrast to this anti-theological reductionism, the field theories of Michael Faraday and his successors have more constructive implications for theology. The main point of the field concept was to turn around the relation between force and body. For Faraday the body was but a manifestation of the force which he conceived as an independent reality prior to the body, and he did so in conceiving forces in terms of fields. His vision was to reduce all the different forces to a single field of force that determines all the changes in the natural universe. In 1974 Berkson showed that this metaphysical vision formed the basis of Faraday's field physics, the point of departure for the different experiments he devised, and for the relatively limited demonstrations of the reality of fields which he achieved by those experiments. The decisive point in Faraday's grand vision was to conceive of body and mass as secondary phenomena, a concentration of force at particular places and points of the field. The material particle appears as the point where the lines of force converge and form a cluster that persists for some time (Berkson 1974, 52ff.).

The turn toward the field concept in the development of modern physics has theological significance. This is suggested not only by its opposition to the tendency to reduce the concept of force to bodies or masses but also because field theories from Faraday to Albert Einstein claim a priority for the whole over the parts. This is of theological significance because God has to be conceived as the unifying ground of the whole universe if God is to be conceived as creator and redeemer of the world. The field concept could be used in theology to make the effective presence of God in every single phenomenon intelligible. Yet

does not such a use of the field concept ask too much of a term of natural science? Would its use in theology amount to equivocal language that has little in common with the meaning of the word *field* in physics? In addition, does not such language misuse the idea of God as if it referred to a factor in the explanation of the world, if not even to one physical force?

The answer to scrupulous questions like these can refer to the fact that the field concept was originally a metaphysical concept. The metaphysical idea of a field that inspired the modern field theories from Faraday to Einstein is retraceable back to the pre-Socratics. The concept is to be found in Anaximenes who conceived of the air as cause and origin of all things which supposedly had been built as concentrations of this thin element. In the German dictionary of the history of philosophical terms (Ritter 1971-, 2:923), Jammer identified this to be the historical origin of all field theories. In the Greek language air was also named *pneuma*, and it is not by accident that in one of the fragments of Anaximenes *pneuma* and *aer* are used side by side (Diels 1934-38, 13 B 2).

According to Jammer, the direct predecessor of the field concept in modern physics was the Stoic doctrine of the divine *pneuma* which was conceived as a most subtle matter that penetrates everything and holds the cosmos together by the powerful tension between its different parts, thus accounting for their cohesiveness as well as for the different movements and qualities of things. The Stoic doctrine of *pneuma* had an important impact on the patristic theology of the divine spirit and especially on its descriptions of the cosmological function of the Spirit in creation. From the point of view of the Christian fathers there was only one major difficulty connected with the Stoic conception of the *pneuma*. The Stoics conceived of it as a subtle material element. This was unacceptable to the Christian theologians because they could not imagine God to be a material body. They rather opted for the Platonic conception of the divine reality as purely spiritual.

Difficulties of this sort no longer burden the field concept of modern physics, at least if ether is not considered necessary for the expansion of waves within the field. Thus, the major theological difficulty with the Stoic field concept has been removed by its modern development; and since the field concept as such corresponds to the old concept of *pneuma* and was derived from it in the history of thought, theologians should also consider it obvious to relate the field concept of modern physics to the Christian doctrine of the dynamic presence of the divine Spirit in all of creation. Such a way of using the field concept would certainly correspond to the connection that Christian patristics established between the biblical affirmations about the divine Spirit as origin of all life and the Stoic doctrine of the *pneuma*.

In substance there is a much closer connection here than that with the Aristotelian doctrine of movement which gained such a fatal significance in medieval scholasticism and in early modern theology. It was the reduction of movement to bodies in Aristotelian physics that became a point of departure for the mechanical doctrine of movement in early modernity and consequently for the difficulties it created for theology. In contrast to the mechanical model of movement by push and pressure the field concept could be celebrated as the inauguration of a spiritual interpretation of nature.

This is particularly true in the case of Faraday's vision of reducing all material phenomena to a universal field of force (Berkson 1974, 317). However, the metaphysical intention of Einstein took a different direction; using a geometrical interpretation of gravitation Einstein reduced the concept of force to a geometrical description of the forceless movement of bodies in curved spaces (Berkson 1974, 318). In this connection one may remember Einstein's skeptical remark on the indeterminacy of quantum physics: "The old one doesn't play at dice." According to the presentation of Einstein's doctrine by Berkson, he was primarily interested in keeping the laws and properties of the field invariant. Could it be that religious options were effective in the background of the conceptual differences between Faraday's concept of a field of force and Einstein's idea of the geometrical character of the cosmic field? Could these be different interpretations of the Jewish idea of creation either in terms of the immutability of the law of the cosmos (Einstein) or in terms of God's powerful presence in the world (Faraday)?

To be sure, even a cosmic field conceived along the lines of Faraday's thought as a field of force would not be identified immediately with the dynamic activity of the divine Spirit in creation. In every case the different models of science remain approximations in that they are all conceived under the point of view of natural law, of uniform structures in natural processes. Therefore, theological assertions of field structure of the cosmic activity of the divine Spirit will remain different from field theories in physics. The difference may be illustrated by two examples, one connected with the question of how the different parts of the cosmic field are related to the field itself and the other dealing with the role of contingency and time in the understanding of a cosmic field.

The first question carries the theologian into the territory of the old doctrine of angels. This fact alone could be sufficient to distinguish the theological use of the field concept from that of physics. Traditional theology conceived of angels as immaterial, spiritual realities and powers who in distinction from the divine Spirit are nevertheless finite

realities. Their activities were related to the natural as well as to the historical world of human beings; they acted either as messengers of God or as acting in his authority or by way of demonic emancipation from God. From the point of view of the field structure of spiritual dynamics one could consider identifying the subject matter intended in the conception of angels with the emergence of relatively independent parts of the cosmic field. However, according to theological tradition angels are personal spirits who decide for or against God. One need only recall the fact that the concept of person in phenomenology of religion is related to the impact of more or less incomprehensible "powers," the direction of which toward human beings and their world is taken as evidence of a kind of "will." This, however, must not suggest further anthropomorphic features. If one considers this background of the biblical language about angels as personal realities, they may very well be related to fields of forces or dynamic spheres, the activity of which may be experienced as good or bad. Still, the difference of such a conception of angels from the later doctrines of medieval scholastics as well as Protestant orthodoxy would be obvious.

SPACE AND TIME

The other question, concerning the relation of a theological use of the field concept to time, leads to even more complex problems. This is true because the field concept is closely related to space. There are a number of good reasons—suggested by both philosophical as well as scientific thought—to consider time and space as inseparable. Einstein's field concept comprises space, time, and energy. It takes the form of a geometrical description, and this seems to amount to a spatialization of time. The totality of space, time, and energy or force are all properties of the cosmic field.

Long before our own age a theological interpretation of this subject matter had been proposed; it was Newton who offered this proposal. It too referred everything to space or, more precisely, to the correlation of space and force as in the case of a force such as gravitation acting at a distance. Newton's well-known conception of space as sensorium of God (*sensorium Dei*) did not intend to ascribe to God an organ of perception, the like of which God does not need according to Newton because of divine omnipresence. Rather, Newton took space as a medium of God's creative presence at the finite place of his creatures in creating them. Newton's idea was easily mistaken as indicating some monstrously pantheistic conception of God similar to that found in Leibniz's polemics against Newton.

The basic argument of Newton or his spokesman Samuel Clarke was, however, widely discussed in the eighteenth century and has been

considered even in Immanuel Kant's *Critique of Pure Reason*. In its first part, the transcendental aesthetics, the priority of infinite space over every conception of partial spaces was Kant's decisive argument for the intuitive character of space. The theological implications of this idea, however, were not even mentioned by Kant in this connection. More comprehensive consideration of the priority of the infinite over every finite experience had been affirmed already by Descartes' decisive argument in his thesis that the idea of God is the prior condition in the human mind for the possibility of any other idea, even that of the ego itself. If Kant had considered the full implications of the priority of the infinite over any finite conception, his phenomenalism would have become impossible because the subject of experience itself belongs to those things which become conceivable only on the basis of the intuition of the infinite.

Samuel Alexander was quite correct to challenge Kant on this point in his book on *Space, Time and Deity* (Alexander 1920, 1:39, n. 1; cf. 1:147). However, in contrast to Newton Alexander conceived of infinite time and space in such a way as to attribute priority to time. The weakness of Newton's contribution to the subject matter is primarily due to his deficient conception of time as simply duration. Perhaps this deficiency is even responsible, at least in part, for Newton's lack of appreciation of the doctrine of Trinity. In any event a trinitarian interpretation of the relationship of God to the world is closely connected with time and history in the divine economy of salvation.

A discussion of the concept of time and of its importance in the field concept requires considerations that can be hardly touched upon in the context of the present reflections. However, this much may be said: In Kant's transcendental aesthetics—in the case of time as well as in the case of space—the infinite has priority over any finite part. In the case of time this brings Kant's argument into close contact with Plotinus's conception of time in distinction from that of Aristotle. Plotinus argued that only on the basis of the perfect wholeness of life is an understanding of the nature of time possible (Plotinus, *Enneads* 3.7, 3, 16-17; 2.7, 11). The whole of time according to Plotinus cannot be conceived as the whole of a sequence of moments because the sequence of temporal moments can be indefinitely extended by adding further units. Yet, in his view time and the sequence of its units are understandable only under presupposition of the idea of a complete wholeness of life, which Plotinus conceived under the name of eternity (*aion*). In his view the total unity of the whole of life is indispensable in the interpretation of the time sequence because it hovers over that sequence as the future wholeness that is intended in every moment of time. Thus, the significance of eternity for the interpretation of time in Plotinus results in a

primacy of the future concerning the nature of time. Not before Martin Heidegger's analysis of time in the twentieth century was this insight rediscovered, and with Heidegger it was developed only in a limited way, restricted to the experience of time in human existence.

The theological significance of the priority of eternity in the conception of time and of the consequent priority of the future is obvious, at least in the contemporary context of theological discussion impacted by the rediscovery of the meaning of eschatology in the message of Jesus and in early Christianity in general. When Augustine adapted Plotinian ideas about time, the theological situation was different. The primacy of the eschatological future in the understanding of time was not considered important; instead Augustine focused upon the relation of the individual soul to time and eternity. His concentration on the subjective experience of time provided the direction for subsequent discussions of the subject by Kant and Heidegger. Yet Augustine's psychological analysis of the experience of time presupposes the Plotinian ontology of time. This is particularly evident in Augustine's idea that the soul is the place of some continuous presence in the flow of momentary events. His account of this continuous presence in terms of a distension of the soul (*distentio animi*) stretching across the remembered past and the expected future conceives the duration of the soul as a form of participation in eternity.

This returns us to the relationship between theology and science in the understanding of time. If space is to be described as the form of simultaneity of phenomena, then the spatialization of time in physics (already in the preparation of a homogeneous time by the scientific techniques of time measurement and then, further, in the model of space-time or of a universal field comprising space, time, and energy) may be described as an extrapolation of our limited participation in the eternal presence of God, a participation which is granted to us in the experience of our duration in the flow of time. Spatialization, then, is not a mere fiction, as Henri Bergson suspected. Rather, it is rooted in the experience of "duration," the experience which was basic in Bergson's own thought but is also to be understood as constitutive of simultaneity in space as well as of continuity in the sequence of day and night, of summer and winter, all of which had been related to the movements of the skies. The cosmic clocks of the seemingly circular movements of the stars, especially of sun and moon, form the basis for our human division of time into equal segments. Nevertheless, no part of time is completely homogeneous in comparison to any other. This is a consequence already of the irreversibility of the time sequence. Therefore, the spatialization of time in physics remains a mere approximation, even in the model of cosmic field, of the comprehensive unity of the

process of the universe in the irreversible sequence of its history as seen from the perspective of divine eternity.

In distinction from the perspective of physics, the theologian looks at the universal field with the dimensions of space, time, and energy from the point of view of the eschatological future. Certainly, this theological perspective is in its own way limited to approximations. This is obvious in view of the inevitable lack in theological descriptions of the kind of precision available to science. This lack of precision is due to the fact that theology concerns itself with the contingent historicity of reality and with its contingent origin in the incomprehensible God who is incomprehensible precisely in his creative transcendence. Duns Scotus already recognized the limits of theological knowledge, arguing that all theology knows God as well as other individual realities only through general concepts, while God's knowledge (if we are entitled to use that term in relation to God at all) grasps the variety of individual existence in one simultaneous act, in the form of an intuitive knowledge.

THE CREATURES OF CREATION

It seems appropriate to conclude this survey of problems connected with the doctrine of creation by turning at least shortly to the other side of that doctrine, to the products of the divine act of creation and to the emerging sequence of creatures.

The priestly report on creation in the Bible presented the order of creation already as a sequence of creatures that are related to the sequence of days within the week of God's work. They rise one after another: first, the light of the day in distinction from the darkness at night, then water and the vault of heaven, then earth, vegetation, and the stars, followed by the creatures of the sea and the birds until finally animals appear and populate the land, and at last the human being. In the perspective of contemporary information about the course of nature the sequence of forms would have to look different in certain particular cases. The priestly report is, of course, colored by the natural science of its own days. A prime example of this is the conception of a separation of the waters by the massive building of the "vault of heaven." This vault separates the waters below from those above and provides the initial condition for a mechanical process, namely, that the waters below the vault, because their continuous supply from the upper ocean in heaven is cut off, recede to the deeper places, so that the solid ground appears (Gen. 1:6, 9-10). The same mechanism works conversely, when the "windows" that had been placed in the "vault of heaven" are opened (Gen. 7:11). The consequences are reported in the story of the flood.

The cosmology that comes to expression in this idea of a vault of heaven is very impressive, but it need not constrain the believer of the twentieth century. The theological doctrine of creation should take the biblical narrative as a model in that it uses the best available knowledge of nature in its own time in order to describe the creative activity of God (Schlink 1983). This model would not be followed if theology simply adhered to a standard of information about the world which has become obsolete long ago by further progress of experience and methodical knowledge.

The features that show in particular the historical relativity of some information in the priestly report include the relatively late creation of stars. That they appear as late as in the fourth day (Gen. 1:14-19) and only in the utilitarian function of "lamps" is certainly due to the struggle of Israel's faith against those gods of the ancient Orient who were connected with sun or moon or other heavenly bodies. A certain degree of over-reaction is also obvious at this point. In our present situation this is no longer an urgent problem of theology. Much more remarkable than the necessary revisions concerning the sequence of creative forms as reported in the first chapter of the Bible is the extent of substantial analogies between our contemporary and those ancient ideas about the origin and development of creation: the light in the beginning; human beings at the end of the sequence; the beginning of vegetation as a presupposition of animal life; the close kinship between human beings and mammals (the land animals) as creatures of one and the same, the sixth, day of creation. Above all, the scheme of a sequence of steps is still shared by the modern view. Certainly the sequence of steps appears from a modern perspective as an evolutionary process leading from primitive to more complex or higher organized forms. It is at this point that we identify the deepest difference between the biblical and modern conception of a sequence of forms in the process of the creation.

The resistance of many theologians during the nineteenth and early twentieth centuries against the doctrine of evolution was largely caused by their apprehension that the doctrine of evolution would do away with all immediate dependence of the particular creatures on God's activity by deriving the higher forms from their predecessors. This discussion is no longer important at present not only because the doctrine of evolution has been victorious in shaping the cultural consciousness but also because a further development of the doctrine of evolution itself went beyond that dispute. Presently, the proponents of an epigenetic interpretation of evolution in terms of an "emergent evolution" emphasize that later forms cannot be simply derived from earlier and lower ones. A. Lloyd Morgan's title *Emergent Evolution* of

1923 has almost become the catchword of a metaphysical concept of nature, because "emergence" means that on each level of evolution something new and underivable arises. Theodosius Dobzhansky could even call evolution "a source of novelty" (Dobzhansky 1967, 33).

In his *Ecumenical Dogmatics* the Lutheran theologian Edmund Schlink identified the difference between the modern understanding of the sequence of natural forms and that of the priestly report in the Bible to be rooted in the fact "that, according to the biblical conception, the autonomous activity of the creatures is bound to the framework of their concrete order which was given to them in the beginning, while the picture emerging from modern research has been increasingly such that the concrete species of reality developed from the autonomous activity of the creatures before them" (Schlink 1983, 93). Even the priestly report, however, knows and uses the idea that God's creative activity can be mediated through creatures. This is said especially with respect to the earth which according to God's demand produces the different forms of vegetation. This shows that there is no opposition in principle between the biblical conception of God's creative activity and the idea that this activity is mediated through creatures.

Something, however, is missing completely in the biblical report that has become extremely important in the modern description of nature. This is the derivation of more complex forms from elementary processes, a method of looking at things that is rooted in Democritus's theory of atoms. Democritus had already envisioned all complex forms as consisting of elementary components of similar kind and as distinct only because of the different number and connection of those components. It was this idea that influenced decisively the interpretation of nature in modern science. Without this idea the evolutionary theories including that of living forms would be no longer conceivable. This is completely different from the biblical conception of the sequence of created forms. Nevertheless, this does not mean there is a basic contradiction to the implicit intentions of the biblical report and to the idea of creation in general. There is no such contradiction as long as the contingency of each of the newly emerging forms is preserved as is certainly the case in the doctrine of emergent evolution.

If the contingency of new forms is so important, the question must arise as to how contingency is to be reconciled to the peculiar logic suggested by the course of evolution moving in the direction from simple to more complex forms. Again and again philosophical and theological reflection on this phenomenon has arrived at the idea of some intrinsic teleological direction in the evolutionary process. The ideas of Pierre Teilhard de Chardin on this matter became widely known but also became the object of serious criticism. Personally, I

consider more plausible the vision of Michael Polanyi, who argues for the interpretation of the emergence of more or less durative forms of finite reality in terms of phases of equilibrium within the context of a field. He consequently perceives the evolutionary processes of ontogenesis as well as phylogenesis as field effects (Polanyi 1962). In this perspective, the evolutionary processes of phylogenesis and ontogenesis are accounted for on the basis of determinants which are not only localized within the individuals in question or the genes, as the models of sociobiology suggest today, but also the future of the evolving forms is conceived as dependent on the overall status of a field which functions as the environment of individuals and species. Ideas of this kind that have been developed by Polanyi in more or less speculative ways are convergent with Alister Hardy's concept of organic evolution. Furthermore, they not only recommend themselves because they allow a description of organic and inorganic nature on the basis of the same fundamental conceptuality but also because they offer to the theologian a description of life processes in analogy to the biblical intuition of an origin of all life from the activity of the creative spirit of God.

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