



Science in the Bible

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I. INTRODUCTORY REMARKS

This essay focuses on science *in* the Bible, not science *and* the Bible—on the presence and role of science in the Bible itself rather than on the relation of modern science and the Bible. This focus is important because the scientific aspect is just as much a part of the religious nature of the Bible as the religious aspect is inevitable in modern science. Science as well as faith, faith as well as science, belong both to the Bible and to our own time. As we need clarity about the relationship of faith and science in our own time, we need clarity about the relationship between faith and science in the Bible itself—not about faith in the Bible as opposed to science today. And since we normally speak about the Bible as a book of faith, we especially need greater clarity about the role of science in the faith of the biblical generations.

The arrangement of the biblical books in the Christian canon, their contents, concepts, and intentions, demonstrate beyond doubt that neither the Bible as a whole nor any of its books were designed as dictionaries of science, even where parts of them are scientific in character or reflective of the state of science at the time. The biblical books and the Bible as a whole are theologically oriented literature focusing on the relationship between God and the world and the world and God. The Bible speaks neither about God in isolation from the world nor about the world in isolation from God. It presupposes that there is neither a God without the world nor the world without God. By speaking about God's existence for and presence in the world, the Bible focuses on the question of the meaning of the world and gives its witness to the presence of truth in the world.

There is massive evidence that the biblical writers were not only concerned with the knowledge of God but also with the knowledge of the world. Their knowledge of God's presence in the world became transparent through their knowledge of the world. That is the point where "science" became inevitable, especially for the generations of the Old Testament.

The evidence is irrefutable that the scientific knowledge of the biblical writers reflects the state of knowledge at their own time, more than two millennia ago, and the development of that knowledge during several hundred years. It reflects, as it were, the ancient editions of real and imaginable scientific dictionaries, but certainly not the editions of such dictionaries for our time. The difference should come as no surprise. Yet, the biblical writings may not indiscriminately be dismissed as non-scientific because they represent outdated stages of knowledge. Scientific knowledge and practice are constantly changing, and their character is not determined by the difference between what is outdated and what is up-to-date.

The knowledge of the ancients has been called pre-scientific, among other things because of their mythological world-view. Such a judgment is relative, if not inaccurate, because it ignores factors in that knowledge, even in their myths, which belong to the criteria for any definition of science—even a modern one. Rather than presuming one of the specifically modern definitions, it is advisable that we focus on those characteristics in the biblical literature which are symptomatic of scientific thinking, knowledge, and practice. These include:

- *rationality* in argumentation, e.g., about the relationship or interdependence of things in space and time within a system of thought, as in the argument about the dynamic process from cause toward effect
- *consistency* in the relationship between conceptual thought and its expressions in language
- *verifiability* of thought by observation of external factors, e.g., confirmation by external evidence, especially by mathematics, the exacting disciplines of geometry, cosmology, biology, geography, etc.
- the *predictability* of recurring conditions, e.g., days, months, years, annual seasons, on the basis of cosmological knowledge rather than on the basis of the regularity of past experience alone; predictability based on mathematics, including successful completion of projects—large buildings, water-supply projects, production processes; one has to distinguish between predictability, prognosis, and prophecy in the biblical literature
- the *implementability* of theory in, and its confirmation or non-confirmation by, practice.

It must be said, however, that the biblical writers' understanding of the presence of God in reality or their conception of truth was neither confined to the scientific character of their thought nor everywhere based on this criterion. For their understanding, more was at stake than only what numbers could measure, reason objectify, language express, or practice implement—especially where the articulation of the distinctiveness of God was involved. Lastly, the scientific character of their understanding was necessary for reaching out as far as possible

toward a non-chaotic understanding of and non-chaotic life in the non-chaotic order of God's world. Yet it was at the same time, and for that very reason, no more than an important instrument for helping to discern the truth of God and truth in the world, without being itself the criterion.

II. ASPECTS OF BIBLICAL SCIENCE

1. When speaking about science and the Bible or science in the Bible, many think only about creation-science. This is totally unjustifiable. It is worthy of note, however, that, in the fall of 1992, after 360 years of being condemned for defending Copernicus' discovery of the heliocentric system, Galileo Galilei (1564-1642) was rehabilitated by Pope John Paul II: the sun does not revolve around the earth as the Bible assumes after all; the earth revolves around the sun.

Galileo did not become right when the Pope acknowledged his theory. Together with Copernicus and Kepler, Galileo had been right all along, whereas the church had been wrong. It

may sometimes take generations, but an insistence on the validity of the Bible's scientific data must eventually yield to the scientific evidence of newer data. This has nothing to do with loss of faith in the Bible or with undermining its truth. It only brings the data up to date. Further, the Bible's geocentric cosmology did not become incorrect when this incorrectness was discovered. It had already been incorrect in its own time. The assumption that statements of the Bible which no longer reflect our time were nevertheless correct in their own time, because they were made for that time and in its context, is indefensible. Geocentric cosmology was developed in and for its time but was wrong even during that time. Not everything in history, or in the history of science, was correct or true because it was said in the context of and for the needs of its time! Finally, the Bible's geocentric view was not unscientific because it was wrong, but its scientific theory was wrong because it rested on the insufficient state of cosmological knowledge of its own time.

2. Before any other aspect of science in the Bible, we need to consider the biblical languages themselves and the written texts without which the Bible would not exist. These languages are clearly and logically structured, and the texts based on them are for the most part the result of intensive intellectual activity: conceptualized thought, disciplined composition, and rational argumentation as in *the ancient science of rhetoric*. They are anything but impressionistic, in both their poetry and their prose. Languages are the products of structured thought, and as media of communication they require disciplined learning. Already in Old Testament times, public figures did not just speak; they had to be "knowledgeable in speech" (1 Sam 16:18).

What is true for the art of oral speech is even more true for the arts of copying and creative writing. In antiquity—indeed, into modern times—the masses could not write let alone compose literary works. Those who could do so belonged to the cultural elite. The writers of the biblical books belonged to the class of the educated; they were the academicians of their time.

There is evidence that certain parts of the Bible directly represent scientific work, while other parts indirectly reflect scientifically controlled operations in society. This distinction is analogous to the difference between scientific or scholarly publications and practical operations of a scientific nature in our time. Most important, however, is the fact that in ancient just as in modern times, science consisted of many fields. Only if we realize that science is not confined to natural sciences, and that even the natural sciences consist of many fields, can we begin to encounter and appreciate the breadth of science in the Bible.

3. The clearest case of scientific literature in the Old Testament are those lists in which individual subjects or objects belonging to the same group are collected and identified. This type of list belongs to a very widespread practice in the entire Ancient Near East and has been called *the ancient science of lists*. Their basic form, nothing more than the listing of names or items, is simple, but they are anything but simplistic. They are the products of organized efforts to comprehend individually distinguishable identities as belonging together in conceptualized groups, to order their listing according to certain systematized principles—analogueous to the catalogue-systems in our modern libraries based on *library science*—and to classify them in

distinction to other, different types of groupings. These lists represent the intentional effort to collect all available data, and to order or recognize the order of the many ways in which reality is encountered.

Old Testament lists include the tables of nations (e.g., Genesis 10); the frequent references to Israel's tribes, especially in the form of the sons of Jacob (Gen 35:23-26); the clans, generally presented in genealogical form (Numbers 26; 1 Chronicles 1-9); the royal heroes and officials (2 Sam 8:16-18; 20:23-26); the territories and towns and the fortresses on their borders (Joshua 15-19; Num 34:1-15); itineraries of local names (Numbers 33); and material objects, such as offerings (Exod 35:21-29) or booty from military campaigns (Num 31:42-47).

These lists represent systematized, controlled, basically verified or verifiable condensations of knowledge, very often institutionalized and functioning for the sake of theory and practice. They represent the nuclear forms of the *sciences of ethnography* (both national and international), *administration*, *geography*, *topography*, *economy*, *warfare*, *logistics* (for various types of operations), and, we have reason to assume, *biology*.

4. Another clear case of the scientific character of the Old Testament exists in the literary compositions of its *legal corpora* (including *cult-legal* texts). The most prominent examples are Exod 21:1-23:19; Deuteronomy 5-11 and 12-26; and Leviticus 1-7. These compositions, which have their antecedents in some Ancient Near Eastern law-codes (e.g., codes of Hammurapi or of the Hittites), represent legal systems organized for administration. They presuppose not lawyers or judges but systematizing legal theoreticians—people who did more than issue individual laws from case to case or adjudicate specific cases. In the sacrificial cult, these would not have been the priests who performed the regular sacrifices. The composers of these corpora had their specific setting and function. They wrote in their

chambers, not where judgment was held or animals sacrificed. They wrote in light of the demands of the time and for the purpose of societal unity by establishing legal uniformity. In their day their works represented the *field of law as a science*.

5. What is true for the law codes is also true for the biblical works of history. The Pentateuch, for example, presents the history that begins in creation and culminates in the public life, work, and function of Moses, whom it sees to be the most important person since creation for Israel and the world. On the basis of Moses' law in Deuteronomy, the books of Joshua through 2 Kings (the so-called deuteronomistic history) present the history of Israel from Moses' successor Joshua up to a generation after the fall of Jerusalem in 587 B.C. The books of Chronicles and Ezra-Nehemiah are similar works. In the New Testament, Luke-Acts presents the history of Jesus—including his pedigree (Luke 3:23-38) and focusing particularly on his public life and death—and the history of the movement of the early Christian mission until Paul's arrival in Rome.

These and other works belong to the *ancient science of historiography*. They focus on sometimes huge and sometimes shorter periods of the past and virtually always lead up to their authors' own time. They are coherently structured literary compositions, designed to reflect diverse actual events as coherent developments. They were conceptualized from certain

vantage-points with plots and purpose; the authors' own interpretations of the meaning of history pervade their narrative of what happened. In no way are they mere story-telling or mere collections of stories. The materials for these histories had to be collected by the authors, but the authors themselves were historians.

These authors had to rely on diverse sources. Many of these, such as lists, annals, or earlier works, were written; others were oral. To be sure, not all their sources meet the criteria for historiography in the modern scientific sense of the word, criteria that were already established by the Greek historian Thucydides in the fifth century B.C. Yet, despite the legitimacy of these criteria, the works of the biblical authors belong to the erudite study of historical epochs and to the ancient science of historiography.

6. Although they are not themselves scientific in nature, many Old Testament texts presuppose or draw upon the science then existing in society. In this respect, our sources offer indirect but nonetheless sufficient evidence for both a reconstruction of the fields of science in the society behind the texts and for the fact that this scientific perspective informed the texts themselves.

There is the *science of biology*, which at that time clearly distinguished among the subdisciplines of *anatomy*, *botany*, and *zoology*. There is also evidence for differentiated *psychological* knowledge, although the extent to which this was organized into a system remains an open question. However, *anatomical* knowledge about humans and animals was certainly systematic, as the language shows and as texts about the dissection of animals for sacrifices presuppose. Of course, it was less perfected than ours. They were, e.g., unaware that the heart is only a pump and not the seat of thinking and emotion. Their *botanical* knowledge was also systematic, as

shown by the remarkable terminology and the clear distinction between classes of plants. In *zoology* they had classified the diverse animals of the air, the sea, and the land, and subclassified diverse kinds of wild and domestic animals; domestic animals, at least, were still further classified according to types, sex, age, and function. The subclassification of animals included, of course, the clean and unclean distinction. The terminology is again remarkably wide.

The texts use these biological data scientifically, clearly differentiating and classifying (analytically and synthetically) their knowledge of the biological world. Indeed, there is good reason to postulate the existence of *catalogues* of biological science in ancient Israel on which are based references such as those in Genesis 7, Psalms 104 and 148, and Job 38-39.

7. We know there were physicians in ancient Israel, among whom priests were included. Of course, the one healer above all—and in the work of all—was God (Exod 15:26). Diagnostically, the Old Testament specifically identifies a large number of physical illnesses, including, among others, blindness, lameness, diverse skin and sexual diseases, diseases of physical organs, stroke, wounds, and various psychopathological conditions.

Therapeutically, medicine answered with an array of treatments by oils, balsams, bandages, specific waters, and other naturally based medications. It knows about mouth-to-mouth resuscitation, although surgical practice does not seem to have been firmly established.

Important, however, were preventive practices, obviously representing officially established and enforced policies, such as “temporary isolation, quarantine, burning or scalding of infected garments and utensils, thorough scrubbing and smoking out of houses suspected of infection, and scrupulous inspection and purification of the diseased person after recovery (Lev. 13-14).”¹

The state of medical knowledge discernible in the Old Testament did not, of course, remain the same during the more than eight hundred years of Israelite history. But it is clear that a great amount of medical knowledge for prevention, diagnosis, and therapy had been developed and accumulated; this far exceeded the abilities of the average person. In its detail, comprehensiveness, and erudition, this body of knowledge and practice required the profession of the trained physician; it reflects the state of *medical science* at the time.

8. In Exod 25:3-7, Moses is instructed to ask the Israelites to offer the types of materials needed for the construction of the sanctuary and its furnishings, and according to Exodus 35 they bring these materials. The text itself is a systematized, comprehensive list of the types of materials needed for the operation. Such a list reflects the planning stage of such operations, taking place in the rooms of the planners, normally after the specific blueprint is ready, when the question arises about what materials need to be procured. It belongs to the *science of management*

¹Cf. “Medicine,” in *Encyclopedia Judaica*, vol. II (Jerusalem: McMillan, 1971) esp. 1179-1180.

and logistics, which has not at all received the attention it deserves in biblical studies, especially on the subject of science in the Bible. Yet it is this field which is most discernible in the institutionalized operations which stand behind many Old Testament texts, especially after the establishment of Israel’s statehood.

a. Under the monarchy, the administration or management of the state required a conceptualized system of organization which, in one sense, replaced the way the premonarchic tribal confederacy had functioned and, in another sense, was superimposed over the older one. This organization involved both theory and practice. Specialized departments were established and required coordination; these included first and foremost the state religion and its cult (the first temple in Jerusalem and the sanctuaries in Dan and Bethel were royal sanctuaries), but extended also to law and justice, the royal administration of the tribes, treasury, economy, international relations or foreign policy, state-owned land holdings, industry (especially for state projects), and the military (its use in warfare and its maintenance in peacetime). These institutions can be observed behind a host of Old Testament texts.

Without doubt, the Israelite monarchy was rationally and systematically organized, in analogy to other Ancient Near Eastern states; as the Jerusalem traditions show, especially in the Psalms, the monarchy was thought of as the implementation of divine order on earth. Its only difference from the surrounding nations was its monotheistic theology which further strengthened the tendency toward an integrated and united society. Not coincidentally, Deuteronomy’s program for Israel is understood to be based on the concept: one God, one people, one land. This kind of theoretical conceptualization presents a particular form of the ancient religio-political systems. It provides the ideological basis for *political science*, especially for the *science of government*. The sciences of management and logistics serve the

implementation of political and governmental sciences.

Two other areas involving management and logistics will be mentioned. One involves the operation of state buildings, the other the operation of warfare.

b. The biblical references to the temples in Jerusalem are well known. Of particular importance for our topic are the narratives about planning and construction (1 Kings 5-8; 2 Chronicles 2-5; and Ezekiel 40-43). Here, however, we will focus on another narrative describing the sanctuary in the Sinai desert (Exodus 25-27 [28-31:11] and 35-40). This narrative might be taken less seriously than the others because the existence of the sanctuary is highly unlikely for the time and place described. Under discussion, however, is the scientific character of its conceptualization, reflecting the reality of such operations, not the historicity of its existence or the meaning of this “historicizing” narrative. Even in its highly mythological form, this narrative reflects the actual processes of management and logistics required for such operations, from the initial stages until the moment of the deity’s occupation.

The report—so named because it intends accurately to reflect reality—focuses on the two major stages of planning and execution. In the planning stage, the deity commissions Moses to summon the Israelites for the offering of materials.

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The deity’s decision to have the sanctuary built is presupposed. A call has to reach all Israelites regarding this offering. It includes information about the types of materials needed. Then the deity reveals to Moses a verbatim description of the blueprint of the sanctuary (elsewhere in Ancient Near Eastern tradition and in later Israel, this description would have been given to the king). Before construction, there has to be an exact detailed blueprint, which in actuality would be drafted in the offices of architects.

Such drafting requires a comprehensive knowledge of the materials and a familiarity with the mathematics needed both for the design of each structural component and for putting the various components together—the technological knowledge for the layout of the entire project. It involves scientific knowledge of the theory, production, and functionality of the works of art. Furthermore, it involves managerial and logistical planning, such as selecting and recruiting the experts who function as foremen of the construction crews (Exod 31:1-11). The text presupposes that these foremen and artists will receive the blueprint for construction before they go to work.

The execution implements the planned project. It takes place at the construction site rather than at the sites of commissioning and decision-making or in the architectural offices. Now, the community is asked to provide the supplies. These must be collected at their own respective locations, transported, and deposited at the building site in the order of their types—an eminent logistical task on its own. Then the experts are called in to set up their particular work. The people bring the materials, and the construction takes place using the plan provided; when it is completed, the building is ready for occupation.

It is clear that the narrative reflects the concepts needed for the management and logistics of the total operation, just as in modern times. The rationality and sophistication of this conceptualization is obvious. If analogous conceptualizations of theory and practice have anything to do with science in our time, these biblical texts reflect the *science of architecture and construction*, and their *management and logistics*.

c. In Numbers 1-2, we have the clearest of all references in the Bible to the organization

of an army in preparation for a military campaign. The surface of the text reflects the background of such events. It reflects *the management and logistics of military science*. The operation is conceptualized in two stages: the registration or conscription of the draftable men and the mobilization or induction of the draftees into the camp.

The registration involves a monumental process. Since its basic divisions presuppose the tribal system (envisioned as forming a militia, not a professional army), the registration had to be organized and supervised by a representative officer of each tribe. Each tribe is subdivided, and each qualifying person must individually register—apparently by having his name entered in a registration list (this requires registrars who can write). The lists thereby established provide the basis for determining the number of registrants at each stage: from the family (or clan) to the tribe and finally to the total number of all tribes. This process had to be

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organized, supervised, and executed at different places by many persons with different functions. We do not know whether such a process ever took place in ancient Israel or in any ancient nation for military purposes. (That census for taxation took place must be assumed.) Nevertheless, the imagined structure of this elaborate process reflects the scientific theory behind it. It certainly indicates a purpose for which actually existing genealogical lists could also be used.

After the registration, which does not happen in the camp, the draftees are called up into the military camp. They are inducted or mobilized. The camp is laid out in a quadrangular or rectangular pattern, which is the layout for the encamped and defensive order. When on the march, the tribes are in a linear formation. Three tribes are encamped on each of the four sides, surrounding the sanctuary. The location of the sanctuary, in the center of the camp, is not determined by the location of the tribes, but rather the location of the tribes is determined by the location of the sanctuary. Their function is to protect the sanctuary. The real campaigner is the deity, accompanied by its host. This religious imagery should come as no surprise, and provides no basis for calling the organization of the camp unscientific, unless we want to declare any organization for military warfare, up to the present time, unscientific because it claims to act on behalf of God.

9. We return to Exod 25:3-7. Its reference to making metals available for the production of metal objects presupposes not only the expert knowledge of the metallurgical process, a science in itself, but also the differentiated knowledge of various metals, including their different values and usages. The Bible's use of words for pure metals such as gold, silver, copper, tin, iron, and lead, and for alloys such as bronze (copper mixed with tin, lead, or antimony) signals the knowledge to make such distinctions; the use of names in a series, such as gold-silver-bronze, shows a knowledge of their relationship systematized in a value-system within which each metal has not only its commercial but also its functional value. In the transition from the Bronze Age to the Iron Age, about 1200 B.C., gold held the highest value commercially and for the production of works of art whereas iron became most valuable for the production of arms and—where affordable—plows. Such systematic knowledge and its application are indicative of the *science of metallurgy*.²

In order to appreciate the high level of theoretical and practical knowledge behind the reference in Exod 25:4 to “blue and purple and scarlet stuff,” one must envision the expertise

needed first to gain the original materials and then to process them through the several stages of production (the *science of cloth production and dye-making*). The same must be said of the many sorts of jewelry listed in a passage like Isa 3:18-23 (the *science of jewelry*).

Exod 25:7 refers to precious stones, as do other passages, also in the New Testament; these include onyx, bedellium, amethyst, jasper, beryll, smaragd, rubin, lapis lazuli, chrysolid, diamond, sapphire, amber, coral, and pearl. The

²Cf. "Metals and Mining," in *Encyclopedia Judaica*, vol. II, 1428-34, and similar Bible dictionary articles.

physico-chemical formulas for these minerals were not known, but their classification in a special category expressed by the formula "precious stone" (2 Sam 12:30; 1 Kings 10:2.10; etc.) points to the state of the *science of mineralogy* at the time.

10. Because of space limitations, we can only allude to *philosophical science* in the Bible. If philosophy is, to some extent, acknowledged in modern times to be scientific—i.e., not merely speculative but based on empirical disciplines and logic—the same must be said of the philosophical nature of many biblical texts, also insofar as they include God in the rationality of thought. What is properly called philosophy depends thereby much more on the kind of thinking, the *Geistesbeschäftigung*, than on the format, especially when compared with the format of treatises from Greek philosophy on (although even there the Socratic dialogue was an appropriate philosophical form).

The books of Job and Ecclesiastes represent philosophy. Their discussion focuses on the issue of a conceptualized worldview and its problems, a worldview that stands behind virtually the entire Old Testament and many texts in the New Testament. It is the so-called dynamistic ontology which says that reality is a dynamic process from beginning causes to their corresponding ends. The fact that this ontology had in the Old Testament already become subject to contestation, modification, and complementation, means neither that it has been abandoned in the wake of the historical development of philosophical discourse nor that it is not also empirically verifiable—alongside complementary or alternative propositions—then and today.

11. What, then, about creation in the Bible? After what has been said thus far, which is only a part of what needs to be considered, it should be evident that the scientific aspect in the Bible's references to creation must not be considered in isolation from the totality of the state and function of science in the Bible. Creation thought presupposes the total context of those times, without which the claims of the biblical messages to be understandable and valid could not have been made transparent.

While significant, the references to the creation of the world are actually very few when compared to the overwhelming attention paid by the Bible to the affairs of this ongoing world (in the Old Testament) and to matters of Christian life (in the New Testament). Besides Genesis 1-2, references to creation are found primarily in Isaiah 40-66, Job, a few Psalms, and some other Old Testament passages, and in the context of particular arguments in not more than twenty passages in the New Testament.³

One must distinguish between the place and function of the Bible's attention to creation and the massive preponderance of its attention to the presence of God in the ongoing existence of

the created world. It is significant that most of the scientific knowledge in the biblical texts and their background reflects the Bible's

³The specific texts can be found in biblical concordances and dictionaries.

constant and unlimited attention to present reality, to the past, present, and future of reality *after* creation, rather than to the beginnings of this reality.

It is clear that not each of the Bible's statements about creation is scientific simply because it is made by the Bible. Quite apart from the fact that variations exist that cannot be harmonized, we must admit that, except in part for Genesis 1, scarcely any of the biblical statements about the creation event fulfill the criteria for being derived from, based on, and reflective of what can be said in light of the mathematically certifiable data available at the time. Other than the Bible's witness to the one God who created the world as order out of chaos—the notion of order being derived from verifiable observation of the structure of the cosmos—its images of the mode and process of creation are genuinely mytho-poetic and influenced by Ancient Near Eastern traditions. Their mytho-poetic nature does not mean there is no truth in them; it only means that the roots of their knowledge lie in what *imagination produces* rather than in scientifically obtainable data.

The preponderance of mytho-poetic imagery is perfectly understandable; it reflects the basic human question about the origin of the amazing cosmic order in the midst of and despite the reality and possibility of universal chaos. This question arises at a time when verifiable access to those primordial beginnings was not available and when even what could be said about them scientifically could be said only on the basis of inferences or conclusions drawn from the present order (including the presence of God in this present order). Nevertheless, this mytho-poetic expression of the mode and process of creation cannot escape comparison with the growth of accurate knowledge; mytho-poetic imagery will be controlled and, where necessary, replaced by constantly developing knowledge.

Genesis 1 was not written for a scientific dictionary, neither for its own time nor for ours. It represents the beginning of the Pentateuch, the conceptually unified work that was subdivided into the five books of Moses from Genesis to Deuteronomy. Genesis 1 cannot legitimately be read in isolation from that total work. Its goal, above all, is the establishment of Israel's sabbath week, culminating in the sabbath day, just as the creation in six days culminates in God's sabbath day. It aims at anchoring in the very creation of the world one of the two distinctive marks by which the post-exilic community of Israel was identified (the marks were sabbath and circumcision)—cf. Exod 20:8-11; 31:12-17. Clearly, the seven-day pattern dominates the structure of Gen 1:1-2:4a, so much so that eight distinct works of God had to be accommodated within six days rather than eight. The historical origin of the seven-day week lies, as far as can be said, in Israel's own history, somewhere in the ninth or eighth century B.C.; but it is not based in the scientific state of cosmological knowledge of that or any other time (as are the annual, monthly, and daily cycles). This seven-day pattern, unique among all other creation traditions, wants to say that, unlike the other cycles (for the permanence of which the "greater" and "lesser" light are universal signs), the sabbath is not constituted by a cosmically verifiable order and not permanently indicated by the regularity of sun, moon, and stars; rather it is constituted by a unique, non-cosmic order of creation, and indicated by Israel's own sabbath week. The roots for

complementarity of the creation week and Israel's week lie in Israel's concept of its own election.

Nevertheless, in other respects Genesis 1 reflects the contemporary level of scientific knowledge of cosmic structure: each part being in its proper place within the whole and in relation to all other parts. It is the result of an intensely reflected effort to present the origin of this structure as a clear, conceptualized system—the implementation of a design for a cosmic architecture in which God is presupposed to have been both architect and sole executor through nothing other than the divine word. In order to focus on the origin, however, it had to narrate the event as a sequence of successive stages rather than to describe the permanently existing order. In transposing the description of the existing order into a narrative about its origin, it had to narrate this origin as a sequence of events that was itself clearly structured. As in the construction of buildings, what is to be done must be done in proper sequence because each phase is at the same time presupposed by the preceding phase and the condition for the following phase. The sequential order in the structure of the narrative reflects the *science of management* in actual construction processes.⁴

The goal of the creation of the cosmos is the creation of the earth as its center, especially of the land, and ultimately of humans as the purpose of all creation. Of great importance is the fact that creation is seen under the (scientifically established) aspects of *space as well as time*. Any discussion that considers Genesis 1 only under the aspect of time and not also under the aspect of space misreads this chapter.

It is also significant that Genesis 1 understands creation to be the beginning of both the stable cycles of cosmic order and the unstable processes of human history. The permanent and ongoing cosmic cycles give rise to the Ancient Near Eastern and Israelite calendric system, which, in turn, is the basis for Israel's agricultural life; but creation also produces a forward moving and always changing human history. Both cyclic and linear structures of time (within the structure of cosmic space) derive from creation. The existence of humanity is imbedded in and structured by both the ongoing cosmic order which we call the order of nature (not "natural order"!) and the march of human history. Human imbeddedness in the cosmic order is not only the basis for the possibility of human history but also the yardstick for its truth and survivability.

The cosmology of Genesis 1 sees the earth as the center of the universe. The earth is raised out of the chaotic waters that remain beneath and around it and is protected from the same kind of waters above by an inverted bowl with solid windows; sun, moon, and stars are placed on the underside of this bowl. This cosmology represents the scientific, essentially astronomical information of its writers, even though it has been outdated now for centuries. Indeed, quite a number of Old Testament texts rest on the ancient *science of astronomy*. We must notice, however, that the use of astronomical knowledge by Genesis 1 and the

⁴For the details of this creation process, see the various commentaries and lexica.

entire Old Testament excludes an astrological application—an application widespread in the ancient world but banned in Israel. Heaven and the stars were not divine. They were

demythologized, seen as serving the humans rather than as governing them and being worshiped by them.

In contrast to the outdated elements in the cosmology of Genesis 1, the narrative's concept of a *sequential* creation is essentially as we see it today, even with the help of Darwin. The sequence moves from the cosmos to the earth; on earth it moves from water to land; life moves from the sea to the air to the land animals to the humans, and the narrative includes knowledge of the variety within and the distinctiveness of each type. Had their state of information given them the evidence we possess that these types evolved one out of the other, there is no reason for disputing that they would have said that God created it this way.

Genesis 1 says that the world was created in six twenty-four-hour days and that God rested on the seventh day. The Bible says nothing about how long ago that happened. That, according to the Jewish calendar, it happened 5754 years ago is determined by using diverse chronological data filtered out of the Hebrew Bible by later interpreters in the Jewish tradition. We know that the universe is much, much older, that its origins go back some ten to eighteen billion years, and that a mathematical game with texts like Ps 90:4 is beside the point. Adhering to the biblical state of cosmological knowledge only stands in the way of our own awe, reverence, and love of God; it hides what it means for us to speak about the truth of God in the light of our own constantly increasing knowledge of the vastness of the universe, the continuing secret of its origin, and the wondrous precariousness of this little planet in a solar system at the outermost fringes of one of millions of galaxies—a planet that is our only home. The universe, this earth entrusted to us, and their God are immensely greater than the writer of Psalm 8 could ever have imagined.

III. CONCLUSION

It cannot escape attention that the aspects of science in the Bible discussed here are found almost exclusively in the Old Testament and play scarcely any role in the New Testament. This difference is not coincidental, and the reason for it would not change even if we were to discuss instances (e.g., the phenomenon of rhetoric) which demonstrate a scientific character in New Testament writings as well. Its basic reason lies in the fact that in their present form the books of the New Testament, except the Johannine literature, focus on the eschatological condition of the world, the human race, and the Christian community; they anticipate the impending end of this world in the second coming of Christ and its replacement by the new creation. In light of this expectation, the Christian community was called to consider its existence and to prepare for the second coming and the appearance of the new creation, which in a certain way was already a reality.

This temporal eschatology has not been fulfilled, just as none of the temporal eschatologies in the prophetic writings of the Old Testament was fulfilled as stated and conceived. Its hope for the ultimate consummation of the world was scientifi-

cally unverifiable in the same way the biblical texts about the origin of the world were unverifiable and could be inferred only from the experience of the existing order of the world. If, by analogy, our current knowledge of the existing order is a basis for inferring the hope for the world's future, this cosmic future appears to be open for a very long time—save a natural

cataclysmic event or our own destruction of the globe. At any rate, the history of the past two millennia and the current state of our scientific knowledge conflict with the expectation of the second coming of Christ and with the replacement of this world by a new world in a temporally conceived eschatology.

In the meantime, the created world has existed and continues to exist. It seems to be better, if not decisive, that we focus on God's presence and the ultimate meaning of God's presence in the affairs of this ongoing world. After all, the Bible teaches us that God was at the beginning and will be at the end because God is always and everywhere present, not that God is present now because God was at the beginning and will be at the end. Thus, the Old Testament's attention to the affairs of this ongoing world, to the question of truth in and for the world—including the texts' attention to scientific knowledge for the better understanding of that truth—serves a decisive function for the human race and certainly for the Christian community. Appreciation of the Old Testament in the Christian canon acknowledges its fundamental rather than only peripheral importance, an importance unlike any it has had in the history of the interpretation of the Christian Bible.

There is one fact that neither the biblical faith nor its scientific aspects could ever have imagined. For the biblical generations it was inconceivable that the existence of the earth, or at least of life on earth, could ever end by human hand; the hand of God alone would determine when the earth would "wear out like a garment," when God would "change them like clothing, and they pass away" (Ps 102:26 [27]). Up to our very own generation, even the progress of science could be understood as the implementation of God-given human facilities within the cosmic order. This order provided an untouchable solid foundation for the earth and all life. With our generation, however, this history has come to an end forever. From now on, the question is not only about science *in* the Bible or science *and* the Bible but about the role of God in view of the human ability to destroy God's earth and to commit the suicide of the human race—this in comparison to the role of God in the past who alone determined and guaranteed the earth's existence. The question of science in the Bible or science and the Bible is now surpassed by and depends upon the question of our task and our ability to uphold the creation of this earth in the face of our own ability to bring it to a premature end. What this question means for our reading of the Bible and for the Bible's potential for us is an entirely new—as yet scarcely even recognized—problem.

ROLF KNIERIM has particular interests in Old Testament theology and form criticism. A collection of his essays, *The Task of Old Testament Theology*, will appear soon.