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Culture in a New Scientific Worldview

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ABSTRACT

In the past decades, the scientific view has changed from static to a dynamic universe. So should our worldview progress and, in particular, the relation between science and religion. In today's scientific worldview, the future is open. The universe is not a clock, but an adventure. Though not directly expressed today, science is often perceived implicitly as the key to the foundations of reality, a function previously assumed mostly by religion. However, science does not include all of human experience, nor does it pose and answer ultimate metaphysical questions. Thus science is not complete and does not fulfil the necessary conditions to be a culture. Scientific results form a part of culture and should be amalgamated with the rest. The relation between science and religion must ultimately develop beyond the classical forms--conflict, ignorance, dialogue, or integration-- towards a collaboration between engaged scientists and theologians pursuing well-defined goals.

THE LIMITS OF SCIENCE

Scientists are curious people, eager to learn. As a curious person I would like to understand religion and, in particular, the teachings of Jesus, and the subsequent theological reflections. I do not need to investigate them at a scholarly level, but want to appreciate them. However, I wish to do this without having to plunge into antiquity. It is a matter of lacking time and training, but most of all, for me, of remaining true to the language and thinking of the environment in which I am working as a scientist. The study of the Hebrew and Hellenistic cultures two thousand years ago, essential for theological research, cannot be a prerequisite for faith in our times. To understand Christianity, and to make it understandable to others, a translation is needed into a worldview that reflects the current scientific knowledge. To reach this goal, the relation between science and religion must evolve far beyond the present state. A prerequisite for successful dialogue of science with the humanities, and in particular with theology, is that both methodologies are clearly known. Preconceived ideas on the scope and claims of the other side have been the source of many misunderstandings in the past. Theologians and scientists may not even agree on the limits of their own fields, but must at

least be willing to reflect on them. Thus, before starting the dialogue, these methods, limits, and goals need to be discussed.

In the 1950s, science appeared without limits in the public eye. In this mood, Charles Snow (1993) declared in 1959 science to be an independent culture, eventually to replace “traditional culture”. Much of his arguments are long outdated (Kimball, 1994: 10), yet the question of the cultural content of science and its limits remains. Scientific results may be unapproachable for many reasons, including the recondite mathematical nature of contemporary scientific discourse. On the other hand, scientists can still be found that follow an ideology of an “observer-independent” description of reality by entirely rational and dispassionate science as demonstrated in a recent scuffle (Sokal 1996, and related debates, in particular Beller 1998: 31). If physical theories are not mirrors of reality and thus not identical with reality, the total of reality is larger than the realm of scientific investigations. The present worldview is influenced by the limits of science and how we appreciate them. They have different origins: Limits may emerge intrinsically from the nature of the object that is investigated, when science cannot get a grip on it, or questions may be beyond the scope of science, thus its methodology is inappropriate. Both will be illustrated in the following.

THE DEVELOPING UNIVERSE

Half a century ago, the paradigm of the clockwork universe was still much alive. The interplay of cogwheels was the dominating metaphor. If science knew all cogwheels, the function of the clock would be completely known and its future state could be completely determined. The future would be set as firmly as the past. Later, the paradigm changed to a computer, still assuming incorrectly that the cosmic processes operate predictably on the long term. This paradigm, originating in to the Age of Enlightenment, prevailed until the late 1970s, when Erich Jantsch (1975), Ilya Prigogine (1980) and co-workers made us aware of the dynamic nature of physical time.

In the 1950s, the dominant cosmological model was the steady-state universe. This changed only in 1965 with the discovery of microwave background radiation. It strongly suggested a beginning of the universe out of a hot, dense state: the Big Bang as it came to be known and generally accepted. Today, the Big Bang is dated 14 billion years ago within a margin of about one billion years (Tegmark 2004:21). Using some plausible assumptions, the age of the universe can be dated even more precisely to 13.7 ± 0.2 billion years (Spergel 2003: 175). However, the Big Bang model did not confirm the paradigm of the clockwork universe. The more astrophysics developed due to the splendid new observing facilities from the ground and from space, the more it became clear that the universe did not start like a theatre: When the stage is set, the light is on, the actors are ready, and bang! The curtain rises and the play begins.

The coming into existence of the present universe took much more time and was more dramatic. None of the celestial objects in today's universe was present at the time of the Big Bang, no galaxies or stars, not even matter as we know it today. All emerged in the course of the cosmic development: The components of atomic nuclei, protons and neutrons, formed a fraction of a second after the beginning. Helium originated one minute later, and galaxies and stars after half a million years, when the universe became transparent (Freedman and Turner, 2003: 35). Earth-like planets formed from the dust produced by many generations of stars. Sun and Earth formed only 9 billion years after the Big Bang, thus in the second half of the

present age of the universe (Allègre 1995: 1453). Life on Earth came into existence 10 billion years after the Big Bang (Byerly 1986: 489). Human consciousness emerged even later, just a few hundred thousand years ago. The developments then proceeded further, with very rapid social, technical, and cultural developments in the human society continuing through the present. Thus, most importantly, new structures and entities continue to form today!

The universe did not just continuously improve. The development occurred in steps: The phase change in the cosmic gas from ionized to neutral, making the universe transparent, was a necessary condition for star formation. The death of stars of the first generations was the condition under which cosmic dust developed and planets formed. Planets were the necessary conditions for advanced chemical processes and biological evolution. The development of the universe from elementary particles to living beings was astoundingly dynamic. New dimensions of development opened in that process. The development was often unpredictable due to the many interacting elements in the system, making it highly non-linear. Such systems are chaotic in the sense that the long-term future cannot be forecast.

Star Formation as Example: The history of human insights into star formation may serve as an example of how astrophysical theories evolve and where they lead. In 1692, Isaac Newton already had the notion of stars forming out of interstellar gas (1957: 210). As for the driving force, Newton suggested gravity, thus a natural process. He could not explain how orbiting planets form in a collapsing cloud. Immanuel Kant proposed in 1755 that the planets originated in a rotating nebula: Nothing but mechanics was involved (1960: 276). His theory also had a gap: Why does the nebula rotate? Simon Pierre Laplace (1836) explained the rotation correctly by the conservation of angular momentum in 1796. Thus, he thought that he had filled all gaps. When asked by Napoleon what role God played in his theory, Laplace proudly answered: “Sire, I do not need that hypothesis.”(in Bell 1937: 181) However, Laplace’s contemporaries soon pointed out that the conservation of angular momentum would prohibit the nebula from further contracting and forming the star.

Today, we know that stars indeed form in rotating nebulae, termed accretion disks. They loose angular momentum in jets and outflows (Bacciotti 2002: 230). The magnetic field seems to play the trick. The magnetic force was barely known at the time of Laplace, and not believed to play a cosmic role. Thus, Laplace’s gap was filled, but we do not understand many other features, such as: How are jets and outflows accelerated, how do meter-sized protoplanetary bodies agglomerate to form planets, or why is the chemical composition in disks differentiated and makes each planet distinct from all others? In fact, we have more gaps today than had confronted Kant and Laplace. The major open questions seem countless. Of course, most scientists still agree with Laplace that the “God hypothesis” would not answer these questions. Apparently, the answers always lead to even more questions. The example shows how complex nature is in contrast to a clock. Although there seem to be only the four classical forces involved--gravity, electromagnetism and the two nuclear forces--the complexity of their interactions makes star formation apparently incomprehensible. What we know is only the tip of the iceberg.

Complexity: Star formation is believed to be the simplest of all cosmic formation processes. Yet, there are more open questions, the more we know. While the white patches of unknown territory on the knowledge map are slowly filling in, the map seems to grow. Thus the map does not get dark, but on the contrary appears more and more white. Scientists in the past have underestimated the complexity of the real world. The reason is the success of the

reduction method in laboratory experiments and their applications in technology. It is amazing, and not at all trivial, that very few basic equations in physics give rise to an immense range of complexity in cosmic processes. Extending the view to living beings, the complexity seems to have practically no limit. Although the basic building blocks seem to be simple, reality appears fathomless.

The complexity of nature has two important consequences: (1) Science is not complete and will never be. There will be no end to scientific investigations. In metaphoric language: The number of cogwheels is not small, as implicitly assumed in the paradigm of the clockwork universe. (2) The complexity is caused by non-linearity: Many processes influence each other simultaneously. In the clockwork paradigm, it is implicitly excluded that independent cogwheels interact. (3) Non-linearity makes cosmic development unpredictable. In brief, the long-term development of the universe is as unpredictable as is next year's weather. As with the weather, however, the future is not completely unknown. There are rules, for example that the energy of isolated systems is conserved. Thus, the Sun will not shine forever. A certain frame of rules is given by the conservation laws, but that frame allows for many possibilities: The future is open. The universe is not a clock, but an adventure.

THE INVISIBLE UNIVERSE

In the 1950s, it was generally accepted what the universe is made of: atoms, nuclei, electrons, elementary particles, galaxies, stars, planets, just everything we see around us. Today, we know that this ordinary matter comprises only 4 percent of the universe. The rest, 96 percent of the universe, is unknown (Spergel 2003: 193). Some 23 percent of the universe is made of invisible, dark matter, such as unknown particles that penetrate the Earth and our bodies without leaving a trace. Dark matter is only experienced by its gravity. The large remainder, 73 percent of the universe, is dark energy for which we have only a word, but no perception other than its action on the universe as a whole, expanding it at an ever faster rate. One might conjecture that dark matter and dark energy do not have genuinely interesting structures and are basically irrelevant. Nevertheless, we actually do not know what 96 percent of the universe is made of.

As a side remark, it may be added that of the 4 percent consisting of ordinary matter we see only a quarter in stars. The rest must be scattered in interstellar and intergalactic space. It may further be mentioned that 8.3 percent of an iceberg's mass is above the water line. We must, therefore, humbly confess that concerning the universe, we see less than the tip of the iceberg. This insight stands in stark contrast with the fact that science has indeed explored convincingly some parts of reality. After all, it has allowed us to explore Saturn's moons and to produce atomic bombs.

Size of the Universe: In the middle of the last century, it was known that the universe contained galaxies at distances of some millions of light-years. Today, we know that the universe is at least 13 billion light-years in size, thus more than a thousand times larger. Compared to Nicolas Copernicus' worldview in the sixteenth century, the size of the universe is delimited a quintillion times larger (10^{18}), and its age is three million times older. Galaxies of billions of stars are a necessary ingredient for the formation of planets. Several generations of stars and billions of years are required for the coming into existence of a conscious mind. The universe cannot be much smaller and younger than we observe it, since this is about the time the human race needed to emerge from the relicts of the Big Bang and the dust of stars

that passed away. We are a part of the cosmic development and our existence is associated with a distinct cosmic phase that requires an age of many billion years. A civilisation like ours could not form and exist in an earlier phase of the universe. We are not isolated in a little corner of the universe, “alone in the indifferent vastness of space” (Monod 1970: 195). The universe and its history are present in each of our atoms. The size and age of the cosmos fit us quite well.

Changes in Science: Science has changed in the second half of the past century in two major ways: (1) The non-linearity of processes in the real world has cast doubt on the capability of science to answer all questions. Moreover, a principal limit on our knowledge also results from quantum mechanics, which became fully established by experiments in the meantime: Uncertainty limits our knowledge of positions and velocity, time and the energy of objects (Aspect 1982). Nature cannot be depicted as a clockwork; and (2) the world is neither static nor eternal. Humanity finds itself as a part of the cosmic process. Scientists are not only objective spectators, but part of this process. This defines our perspective and has consequences for what we can perceive (Carter 1974: 291).

Science in the context of astrophysics and cosmology has become similar to history. As spurred already by geology and biology in the nineteenth century, the universe appears as a development that evolves with time. Time is neither absent nor fully cyclic in the cosmos, but progresses. This marks a revolution in the way science views the nature of time. Half a century ago, there was a dichotomy between the eternal cosmos and the human condition. Now we must understand ourselves as part of a dynamic universe. Both mankind and each individual share their condition with stars, galaxies, and the whole universe. Their condition must be understood similarly within the context of a chaotic development, coming into existence, having an open future and facing decay. It leads to an immediate consequence: As the scientific worldview has changed significantly, so must change the relation between science and theology.

There are clearly parallels, and plenty of material for parables and metaphors. Even more, there is room for interpretations of scientific results by human experience, since they are similar, although on different planes of perception (Benz 2000: 45). We have a significant relation with the cosmos, even with the universe as revealed by science. Thus, there is for a need for hermeneutics of nature, room for cosmic art expressing this relation, and a theology of nature interpreting it as creation.

ULTIMATE QUESTIONS

The fact that the universe has a history means more than understanding the cosmic development as a sequence of processes. In fact, humanity appears in this universe at a given time and place without being asked, much as individuals often feel themselves to be simply thrown into human history. In the 1950s, science was more like a set of certainties. Now, it is not known where the universe will develop in the long term. In an evolving universe, with an open future, some old ultimate questions come to mind, such as: What is our role in this cosmic process? What should we do here? How will humankind develop in the future? Will it have an end? These questions and the fears they express are not scientific, but existential. For that reason, some scientists brush aside these questions as irrelevant. Nonetheless, as a curious person, I would like to know, since the longing for answers is part of becoming a full personality. If science keeps us from asking questions, it has failed its purpose. Yet, the

answers to existential questions must be inspired by perceptions in which the human being comes into a relation with the exterior world and the whole of the universe. Such experiences are not part of the scientific method that separates the inquiring subject from the object of investigation. At this point, my personal interest enters for the broader context of the scientific endeavour, linking science with existential experiences in life.

Is science a culture? For the definition of culture I refer to the work of Ernst Cassirer. Culture comprises “the entire set of human modes of meaning and existence of a society” (Cassirer 1939: 217) and thus must allow for the above questions. Today, they originate from science, and we cannot avoid them in our daily experience of the modern world. They cannot be answered by science though, but by art, philosophy, and religion. Answers can be metaphoric, in stories, appealing to emotions, but not in equations. As science does not and cannot address ultimate questions, it is not a culture. Science is not self-sufficient, not a closed system of questions and answers. It does not include the reflection on itself, but must defer to philosophy, nor can it answer the ultimate questions, but must defer to religion.

At least in America and Europe, science and technology dominate daily life more than religion, the basis of previous cultures. Science also dominates epistemological concepts and philosophy (Gruenwald 1994: 19) not only in the scientific literature and for most practitioners, but for a much larger part of society. It is implicitly taken as the foundation of reality. Although science does not qualify as a culture, it is perceived as such, much like that proclaimed by Snow in 1959. Clearly, science and technology influence our lives, even if we do not understand them. They reach further and deeper than most people realize. Thus science operates like ancient magic; only few people are initiated. To the rest, scientific reality is obscure, just the opposite of what the Enlightenment wanted science to achieve. Even scientists are not illuminated by science, but are scientifically ignorant except in their field of expertise. Yet, the lay public views science as a pseudo-culture. This is alarming as the scientific method is very powerful. We depend on it in our daily life. It is the source of present-day material comfort, as well as of political and military power.

PREREQUISITES FOR SCIENCE-RELIGION DIALOGUE

Let us consider why, on the other hand, religion is capable to answer ultimate metaphysical questions. All major religions started from existential experiences of individuals living in the real world, not philosophical speculations about the universe. Religious perceptions include the granting of a prayer (for example, return of the exiled people to Jerusalem), supernatural visions (resurrected Christ), mystical experiences (burning bush, transfiguration of Jesus), and revelations (prophets). Thus, they start from a human’s relation with the world and beyond. Religious interpretation or reflections based on insights into nature may take the form of creation stories or psalms. Concepts of a theology of nature are developed and assimilated by faith in a later phase. As a well-known example of religious perceptions, I refer to the “memorial” of Blaise Pascal, the French physicist and mathematician. Pascal’s experience is dated 23 November, 1654, and reads as follows: “Fire... God of Abraham, God of Israel and God of Jacob, not of philosophers and savants...” (1954: 554) The perception cannot be expressed in quantitative, scientific terms. Hence Pascal uses the metaphor “fire.” He then goes on to interpret the experience in the theological concepts of his religious background.

It is a necessary condition for a successful science-religion dialogue to know the one’s own, as well as the other’s methods. Science deals with observations and measurements that are

independent of people. These observations are then interpreted by mathematically formulated theories. Science does not include religious experiences like the one quoted from Pascal, which are bound to the person involved, and cannot be made directly understandable to other people. The same is the case with experiences of art, pain, love, and many other things in life. Although each can be made subject of a scientific investigation, the basic perception is not quantitative like a scientific measurement. By the very nature of these experiences, a human being must be involved and participate.

What are the methods, goals, and limits of theology? Samuel Vollenweider, professor for New Testament at the University of Zurich, says: “The goal of New Testament Theology (exegesis) is the prudent interpretation of the most influential book of history with its peculiar message that God becomes present in the life and death of Jesus Christ.” (2003: 315) The goal is not directly related to science, nor even to the human experience of the natural and cosmic world. The interpretation, however, must finally take place and be understood in the present context. This somewhat specific description of theology emphasizes the difference between science and religion. It is important for the dialogue to realize the immense gap between the two, starting from different perceptions and perspectives, spanning different parts of human reality, differences in the goals, methods, and limits, and ending in the language being basically mathematical vs. descriptive and metaphoric. It would be an illusion to ignore the widening gap between science and theology. They have been drifting apart since the end of the Middle Ages. So, today, it is all the more urgent that we find ways to relate them.

Conflict: Ian Barbour mentioned four ways of relating science and religion: conflict, independence, dialogue and integration (1966: 77). There is a tradition of conflicts: Galileo Gallilei, Giordano Bruno, Charles Darwin, et al. Were they really conflicts between science and theology? Conflicts between scientific materialism and Biblical literalism were not known until the nineteenth century. In the above cases, new scientific results were attacked by theologians defending traditional concepts. These defensive battles were in vain, if the issues were located in the realm of science. The conflicts have shown the limits of theology, natural philosophy, and religious cognition. On the positive side, they clarified the theological comprehension of creation. Alas, theology has not yet succeeded in communicating these insights to a larger audience. The inverse should occur more often. Scientists are rarely criticized for transgressing the limits of their method or for uttering strong opinions about things far beyond their expertise. Criticism is still necessary. Conflict is unavoidable when, for instance, the future is at issue. Hope is essential for Christian faith, but may transcend scientific prediction. Dissenting expectations are ingredients of the human condition and must not be superficially harmonized.

Ignoring Each Other: Some Protestant theologians in the middle of the past century argued that science is no resource for theology, and thus irrelevant. In some respects, it may be so. By keeping science at a distance, theology considered itself free to pursue its own concerns. However, the scientific ignorance of many theologians has reduced their capability to make themselves understood in a world increasingly dominated by scientific reasoning. Religion without science loses its language rooted in the metaphors of daily life, nowadays more and more shaped by technology. On the other hand, science depends much less on religion. Science can be pursued like a handicraft without religion. Science may even be misused as an ideological weapon against religion, as practiced by Marxism. The humanities, in particular theology, lose more by ignoring science, than the inverse. They lose their audience in losing the connection to present-day understanding of the physical cosmos, essential to contextualizing theology.

Dialogue Among Equals: Dialogue is the preferred relation of many theologians. I question its intention and capacity. In view of the modern presupposition of science as the foundation of reality, theologians may be tempted to request equal status. However, religion includes both human existence and the natural world. Thus, theology has a much broader scope. Science can scrutinize only the subset of reality that can be sensed by an established set of measurements and observations. The dialogue is not among fields of research sharing the same perceptions, questions, methods, and language. Therefore, after a learning phase causing much initial excitement by expanding horizons, the dialogue may soon lose interest.

Historically, there is no doubt that science has developed from philosophy, and it is widely argued that Christian culture in the sixteenth century made the rise of modern science possible (Jaki 1978: 21). Today, the contributions from philosophy and theology to science are less obvious. I am not aware that a scientific theory was modified in recent time because of a theological argument. Professionally, a scientist does not profit directly from a dialogue with theology. However, scientists gain personal enrichment. The case of Albert Einstein being inspired by Baruch Spinoza's religious perspectives is well known (Jammer 1999: 55). Religion can change a scientist's life, although it does not count in his or her curriculum. Personally, such dialogue helps motivate me to pursue science. Yet, there is a clear asymmetry in the dialogue: The engaged theologians do it during working hours, the scientists in their spare time. Even worse, a scientist engaged in a dialogue with theology has to work overtime to prove that she or he is still a real scientist. It is not surprising that few active scientists can afford a serious dialogue over an extended period. As a result, the dialogue between science and theology is not a mass phenomenon, but persists only between scientists and theologians who maintain a committed interest in both fields.

Assimilation: Learning from each other cannot be the only goal. The relation to which we may aspire is to integrate scientific results into theological language and thought to make it understandable to the modern world. The inverse does not work: Theology cannot be integrated into science for methodological reasons. The relation is not symmetric. The integration of science must be critical, however, keeping in mind that scientific observations are only a part of reality (scientists tend to forget), that theories may be wrong (scientists know very well, but do not always tell), and that claims may be overstated (scientists are human beings). Thus the concept of "assimilation" may be more suitable, but still allows for various degrees. The metaphor of assimilation makes use of a process in physiology meaning to consume and incorporate nutrients into the body after digestion, thus to constructively transform food into living tissue by the process of metabolism. Assimilation of scientific concepts and results thus requires the decomposition of the "scientific worldview" into elements of scientific experience in the view of the assumptions and methods applied. Obviously, the transformation of scientific elements into theological thought must be critical as suggested by the metaphor. On the other hand, assimilation also implies theological reasoning to be consonant with "what science tells us about the structure and history of the physical world" (Polkinghorne 1998: 86).

There are many past examples of assimilating scientific results into theology. Assimilation of Babylonian "science" into Hebrew theology was successful as witnessed in Genesis 1. It assimilated what was apparently the worldview of that time into specific religious experience. It is fascinating to see how the apostle Paul assimilated the Hellenistic worldview into Christian theology and made it understandable for his time. Scholastic theology integrated

Aristotelian and Ptolemaic concepts of nature into theology. Today's challenge should not be underestimated. Systematic theologizing in present-day context requires the theologian to grasp all of cosmic evolution, including for example star formation, as creation. It is not sufficient to assign this quality just to the Big Bang, which is not understood, but "need not have violated any of the conventional laws of physics" (Tryon 1973: 396). To Edward Tryon is also attributed the quote that the universe is just "one of those things that happens from time to time." Since purely scientific concepts for the Big Bang already exist (Guth 1997), the formation of the universe is not fundamentally different from other formation processes, such as of stars, galaxies, planets and living beings.

As noted in the example of star formation, a scientific formation theory will never be as complete as the construction plan of a clock. A good theory explains observed facts, but does not evaporate the mystery of a being. As Carl Friedrich von Weizsäcker put it: "Physics does not explain away the secrets of nature, it refers these back to deeper underlying secrets." (1954: 20) Without this notion of reality's depth, a fruitful science-religion dialogue is impossible. Moreover, the awareness of a practically fathomless reality takes out much of the controversy between science and religion. Assimilation of scientific results means to accept their truth, but not to ignore their mystery. In a broad context, the goal could be to assimilate science into culture.

Bridging the Gap? Bridging the gap is a commonly used metaphor, suggesting a link between two similar banks of a river. It is important for this endeavour to note that science and humanities have become more similar, but operate still on different planes that do not intersect. Aware of the different methodologies, they may be compared and contrasted, but need not to be harmonized. Thus, I prefer the image of intellectually "cultivating the new world" staked out by science so as to render it habitable for humans. Theology must fulfil its defined aim of interpreting the Biblical texts and their message in this new world. Scientific results can be assimilated into the broader concepts of theology in two ways: (1) Interpreting scientific results in the light of religious experiences: Examples in recent times are modern psalms or Pierre Teilhard de Chardin's visions. Then, life emerging from quantum fluctuations and impersonal evolution in scientific terms may be interpreted as a gift from God. (2) Using scientific concepts as metaphors for religious language: An example is St. Paul's parable of the rotting seed in the ground superseded by a growing plant as an image for the resurrection of the dead (1 Cor 15:36). Scientific concepts and technological application forming part of today's human experience then may point to a reality that transcends science and that has common ground with the human condition.

LONG-TERM OBJECTIVE: COLLABORATION

What can we and what must we expect from a relation between science and theology? In addition to helpful criticism (conflict), independent development (ignorance), and learning (dialogue), assimilation must be the final form to achieve the goal of such a relation. Obviously, theologians and scientists fostering a relation must agree on the goal. Assimilation may have the following goals: (1) To rediscover the spiritual reality in a scientifically dominated world. Spiritual experiences are helpful if not necessary to prosper in our world. (2) To communicate what surpasses mathematically modelled reality. (3) To make theology understandable to contemporary man. A prerequisite for communicating religion is to learn science as a language capable of metaphorically expressing spiritual reality. Then Oskar Gruenwald may be right that: "The times are propitious for a renewal of a transcendental,

integral vision of humanity and its place in the cosmos” (2002: 2). (4) Finally and obviously, collaboration is necessary in ethical judgment, when scientific progress raises questions science cannot answer, and where, on the other hand, answers without scientific knowledge are not persuasive. Ethics includes a discussion of ultimate questions.

Assimilation means more than pointing to modern scientific knowledge that supports the scientific worldview of Genesis 1 (Zimmer 1993). The “building blocks” of its worldview are a elements from Babylonian mythology rather than inspired truth (von Weizsäcker 1971: 41). It was the generally accepted “science” in the Babylonian sphere of influence and must not be confused with the message of Genesis 1. Assimilation requires today a theological appreciation and interpretation of scientific theories such as presented for star formation. The result of such assimilation may be a deeper understanding of Genesis 1. A new star is then comprehended both as the result of impersonal laws of nature as well as a creation of God. The theological interpretation may be analogous to more familiar experiences like the birth of a child, perceived at the same time as the result of biological processes and as a gift of the Creator.

These are great challenges for scientifically literate theologians and for theologically minded scientists. The challenge is not only to master intellectually such assimilation, but to communicate it to an audience at large. In fact, assimilation of science into theology and faith cannot be achieved without profound expertise in both fields. Thus assimilation requires collaboration between theologians and scientists. My final point is therefore: Collaboration must become the ultimate relation between science and religion. It can only be achieved between deeply engaged scientists and theologians. Let us, then, cultivate the new ground. To cultivate means literally to prepare land for raising crops. The enormous richness of recent scientific results urgently needs cultivation. It is a great goal for our time. If there will be a culture in the future, it will be a culture that assimilates science.

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