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CHRISTIAN ETHICS AND THE CONCEPT OF CREATION

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The endeavour of science is to find unity in multitude, relatedness in diversity, continuity in discontinuity. By this way reality is simplified for scientific conception and description. With its reliance on observational data and logic, and with the scientific approach to understand the complexity, functionality, rationality and interrelationship of every aspect of reality, natural sciences do bring forward fascinating new insights on the concealed secrets in natural structures and processes. The crucial position of time in the laws of the universe followed from the work of Newton in the late seventeenth century. Newton gave time an abstract existence, independent from nature. Einstein restored time to its place in the heart of nature, as an integral part of the physical world. From the implications of Einstein's time, scientists made one of the most important discoveries in the history of human thought: that time, and hence all of physical reality, must have had a definite origin in the past. Thus natural sciences have to accept the concept of origin. God formed man to glorify him as his earthly steward by giving him dominion over creation. Man is therefore responsible to God, also in his formation of science, by which a miraculous world of boundless diversity and interrelationship from the atomic scale to astronomical vastness is revealed. If we also take account of the transcendental revealed principle of creation, scientific thought becomes open, also in our ethical responsibility.

1. *Introduction*

Reformed teaching recognizes the revelation of God in nature, but God does not speak through nature with either express commands or clear propositions. Christians also put their faith in science, but they know the scientific avenues for discovering truth is not infallible. They know that secular worldviews such as naturalism and materialism are grounded firmly in the modern scientific methodology and enlightened human experience. They know that nature in itself cannot tell us how to live or what it is that is right for us to do. Science, for the Christian, cannot be a principle of authority independent from the Word of God. It is from Scripture that we learn our purpose in the world, and the place our cultural efforts are to occupy. To use empirical observations of mankind's supposedly material welfare, and nothing more, is to ignore the ethical dimension. Scripture must at the onset be our ethical perspective.

Originally, man wished to do what God commanded because he realized it was for his own good. Man would do the best possible work - the greatest self-aggrandizing act he was capable of - by attempting to carry out self-consciously what God had ordained as his purpose in life; the two would work together. After the fall, man saw his own good and the glorification of God as separate ends.

The concept of nature that took hold during the Renaissance, became more and more secularised as man began to seek an explanation for natural phenomena on a basis other than the cosmologies of Aristotle and Scholasticism. Nature has become modern man's most recent symbol for belief in man's independence from God. Man has found a way to transfer sovereignty from

God to nature by introducing the theory of evolution - no further explanations were needed for man's existence.

The endeavour of science is to find unity in multitude, relatedness in diversity, continuity in discontinuity. By this way reality is simplified for scientific conception and description. This leads to the notion that the unity of truth and the unity of reality are rooted in continuity, and that nature inherited no discontinuities or jumps, that discontinuities are expressible in continuity. This enables an evolutionary description of becoming and facilitates the emergence of new structures and complexities from less complex structures, including structures in the biological world.

The biblical account of creation is not that of a continuous process, but an account of discrete supernatural acts. These creational acts cannot be inferred from observations in nature or from scientific investigations. Some people interpret the harmony and order of the cosmos as evidence for a metaphysical designer. For them the existence of complex forms is explained as a manifestation of the designer's creative power. The existence of complex things is even more remarkable given the generally delicate and specific nature of their organizations and structures.

The reliance of modern science on observable data and logic was eventually transformed to the problem of the natural origin of things. The evidence of geology, palaeontology and astronomy suggested that the vast array of forms and structures that populate our world have not always existed, but have emerged over aeons of time.[1] Hence, the theory of evolution becomes credible, embracing a continuous 'growth' into being for all that exists in the universe.

From the Scriptures it is evident that God upholds[2] the universe after completion of his creative acts. He does not merely preserve the universe, but he also governs it. His governance has to do with that continued activity of God whereby he rules all things to secure the accomplishment of his divine purpose. Consequently the universe has to unfold, as it is evident in geology, anthropology and astronomy.

The sovereignty of God is such that the world, that he created out of his free will, depends completely on him for its continued existence (Byl 2004, 183). In general, he upholds the universe from moment to moment, in accordance to the features he has assigned to his creatures and the cosmic laws to which all creatures are subjected. God specifically created man for a purposeful task. God formed man to glorify him as his earthy steward by giving him dominion over creation (Byl 2004, 185). Man is therefore responsible to God, also in his formation of science, by which a miraculous world of boundless diversity from the atomic scale to astronomical vastness is revealed.

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[1] Davies, Paul (1989), *The cosmic blueprint*, London: Penguin Books, 3,4

[2] Byl, J. (2004), *The Divine challenge – on matter, mind, math and meaning*. Trowbridge: Cromwell Press,184.

2. *Ethics*

The word ethics was derived from the Greek word *ethos*, which means morality. This word was first used by Aristotle for sustainable good desire.[3] Hence the meaning of ethics in this study will be accepted as that of good desire, which relates also to the doctrine of the correct moral behaviour of man, and to the norms to which this behaviour has to comply. This doctrine of good desire can be divided into theoretical and practical ethics. The first is an empirical study of different appearances of good desire and how to explain these. The aim of practical ethics is to decide how ethics ought to be and how it should be guided and promoted. Christian ethics will investigate God's revelation on man in the light of His Word and what the desire of man ought to be. The source of practical Christian ethics is therefore the Holy Scripture and in particular God's commandments.

The rationality, that replaced the myth and magic of the ancient Greek people, was built on Biblical foundations after the Middle Ages and formed the basis for the modern scientific world view. The revelation of man and woman made in the image of God (Gen. 1:26) included rationality and creativity and the obligation to study nature and applying that study towards practical ends to the glorification of God for his wisdom and goodness. These considerations strongly motivated Copernicus, Kepler, Galileo, Boyle, Newton and many other Christian founders of science, as is apparent from their writings (Byl 2004, 37).

In philosophy it was René Descartes (1596-1650) who had founded the idea in the modern era by insisting that truth be established by evidence and argument. Whereas Descartes was a rationalist, the philosophers John Locke, David Hume and Immanuel Kant were empiricists, who stressed that knowledge should be based on observable sense data. Modern science with its reliance on observational data and logic is deemed as the best means of acquiring truth about the objective world (Byl 2004, 38).

The world's astonishing comprehensibility is best illustrated in physics. Theories in physics are, in general, of a highly mathematical nature. Physics has been a very successful science primarily because its basic principles can be readily translated into precise mathematical equations. Mathematical manipulations may lead to very specific predictions, which can be confirmed experimentally. These predictions then give rise to many useful technological applications.

3. *Physical theory and language*

Physical theories do not simply flow from observations. A large measure of imagination and invention is also involved.[4] For instance, conservation of energy is a fundamental principle, governing all natural phenomena that are known to date (Feynman 1965, 4-1). This principle (or law) states that there is a

[3] Grosheide, F. W. et al. (eds.) (1925), *Christelijke Encyclopaedie*, Kampen: Kok. 121

[4] Feynman, R.P., Leighton, R.B. and Sands, M. (1965), *The Feynman Lectures on Physics, vol. 1, Mainly Mechanics, Radiation and Heat*, New York: Addison-Wesley Publ. Co., 1-1.

certain quantity, which we call energy that does not change in the manifold of changes in nature. This is an abstract idea, because it is a mathematical principle that says that there is a numerical quantity, which does not change when something happens.

Conservation of energy can be understood only if we have the formulae for all its forms. To physicists energy means capability to do work. A body is said to possess energy when, by reason of its position, velocity, or other conditions, work may be performed during an alternation in the conditions. Thus an elevated body is said to possess energy because work can be done by the gravitational force if the body is allowed to descend. This kind of energy is called potential energy. Energy possessed by a body by virtue of its motion is called kinetic energy.

Galileo discovered the principle of inertia (Feynman 1965, 9-1), which states that if something is moving, completely undisturbed with nothing touching it, it will go on forever, at a uniform speed in a straight line. Newton modified this idea, saying that the only way to change the motion of a body is to use a force. Thus Newton added the idea that a force is needed to change the speed or direction of motion of a body. This is Newton's first law of motion. This abstract idea of a force is quantified by Newton's second law of motion. In this law mass is added as a quantitative measure of inertia.

For Descartes the essence of matter was its extensiveness. Newton did not accept this idea, because for him space and matter differ conceptually. Consequently he introduced the quantity 'mass' as a physical characteristic of matter, independent of extensiveness, and wrote his second law of motion as $F = ma$ (Feynman 1965, 9-2). By this equation he defined force (F) to be equal to the product of mass (m) and acceleration (a). Acceleration can be defined if we know the meaning of position, velocity and lapse of time. This equation simply says that 'if a body is accelerating, then there is a force acting on it'.

It is obvious that scientific language must do more than merely refer to the physical world. It must accommodate also the world of ideas and concepts. Science needs these ideas and concepts to explain observations in terms of theoretical entities and principles (Byl 2004, 123). This world of ideas and concepts proved to be remarkably prolific in practical applications and in technology. By these ideas and concepts reality is reduced to a world that science and technology controls.[5]

4. *Cosmology*

In the natural sciences space and time are fundamental concepts in describing the real world. Classical mechanics expresses Newton's belief in absolute space and absolute time, the cornerstone of classical physics. Newton published in 1687 the *Principia*,[6] which formalized Galilean mechanics. The *Principia* provides a comprehensive system of mechanics, which accounts not only for the

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[5] Schuurman, E. (2005), *Ethics of responsibility,* Iowa: Dordt College Press, 19.

[6] *Philosophiae Naturalis Principia Mathematica* (1687), usually known as *Principia.*

motion of bodies on or near the earth's surface, but also for motion throughout the universe, including that of the moon around the Earth, and of the Earth and other planets around the sun.

Distances in the universe cannot be measured by laying out a measuring tape. A mechanical model has to be accepted to determine at first distances between the Sun and planets. These distances serve then as benchmarks for calculating distances to nearby stars. Next these latter distances are scaled to distant stars and constellations.

According to the laws of classical (Newtonian) mechanics, the planets revolve around the Sun. Astronomically it is observed that the Earth takes 365.25 days (one year) to encircle the Sun. The radius of the Earth's orbit can be calculated in several ways. For instance, Jupiter's orbital period is about 12 Earth-years. Let us measure the point of time at which one of Jupiter's four moons disappears behind the Jupiter's horizon. Let us do this measurement when Jupiter, the Earth and the Sun are aligned, with the Earth at the near side of its orbit to Jupiter. Let us repeat this measurement after six months when Jupiter, the Sun and the Earth are aligned again, but with the Earth at the far side. Now the time of occultation appeared to be delayed by 990 seconds. The event of occultation has occurred now when the Earth's distance to Jupiter has increased by twice the radius of the Earth's orbit around the Sun. This means that light travelled 990 / 2 = 495 seconds ≈ 8 minutes from the sun to the Earth. Using the speed of light, the distance between the Earth and the Sun can be calculated.[7] Today this distance is determined much more accurately, for instance by radar.

The distances of the closest stars to Earth are now calculated from the aberrations (Feynman 1965, 34-10) in the positions of the stars. If the position of a nearby star is measured again after six months, a small displacement is observed. This small apparent displacement from its true position in the sky is explained by the velocity of the Earth in its orbit around the Sun relative to the velocity of light. The distances of the closest stars are then used as benchmarks for scaling distances of distant stars, using stellar brightness and other astronomical features. The ultimate of successive scalings and theoretical calculations is a universe of unimaginable extent.

Einstein's theory of relativity accepts this structural extensiveness of the universe, but looks completely different at space and time than Newton. Whereas Newtonian space and time were both absolute (independent of each other: infinite space with the same time interval everywhere), space and time are now functionally related by the speed of light, which is assumed to be the same (constant) everywhere. The speed of light is now absolute in the sense that it is not relative to anything and in particular that it is not relative to the velocity of the observer anywhere in the universe.

The negative result of the Michelson-Morley experiment (Feynman 1965, 15-3) of 1887, which failed to find any difference between the velocity of light as

[7] Once this distance is known, the velocity of the Earth in its orbit around the Sun and the Sun's mass are obtained from Newton's laws of motion and gravitation, and then follows also the Earth's mass.

measured in the direction of the earth's rotation and the velocity perpendicular to this direction, was solved by Einstein's acceptance that the speed of light is the same everywhere. Now the speed of light plays a dominant role in our view of the universe. Its philosophical implications arise from the impact of our new understanding of space and time.

5. *Quantum mechanics and indeterminism*

According to classical physics, the universe is governed by a set of deterministic equations formulated by Newton and building on the work of Galileo, Kepler, and others. By the eighteenth century, scientists were convinced that these equations would allow the exact prediction of the future state of the world given precise knowledge of its present state and all relevant forces. In such a causally closed world, there would be little need or possibility for God to act in special ways - unless God intervened in natural processes (Byl 2004, 166).

Now with the rise of quantum mechanics early in the twentieth century, a fundamental rethinking is still taking place regarding our view of nature (Byl 2004, 68-81). During the period of 1900-1930, a variety of new theoretical approaches were produced in light of the astonishing experimental data arising from atomic physics.[8]

Fundamental physical concepts inherited from classical mechanics underwent a radical revision, including our notion of the state of a system, its motion in space and time, and the causes of its motion. For instance, the well-known Heisenberg uncertainty relations (Feynman 1965, 6-10) force us to give up the elementary realism (particle and wave trajectories) of classical physics (Russell 2001, vi). We can measure the velocity (or momentum) and the position of a particle, but we cannot say that it has well-defined values of coordinates and velocity simultaneously. These relations introduce an indeterminism in the theoretical description of dynamics on atomic scale. Consequently, the future can no more be determined by the present as in classical physics.

It is remarkable that this change from determinism to indeterminism results basically from a better understanding of the limitations of the measuring processes because of the necessity to take account of the role of the observer. This is a recurrent theme in most of the basic ideas that originated with the development of physics in the 20th century.[9]

Quantum mechanics has been stunningly successful in predicting and explaining phenomena over a wide range of scales, from the subatomic to the macroscopic. Nevertheless, the philosophical issues raised in attempting to give quantum mechanics a satisfactory interpretation have been debated from its

[8] This includes the quantization of energy and angular momentum, the Pauli exclusion principle, and the Heisenberg uncertainty principle, and such bold theoretical formulations as the Bohr model of the atom, wave mechanics, matrix mechanics, and (nonrelativistic) quantum mechanics. See e.g. Russell, R. J. (2001), 'Introduction', in R. J. Russell et al. (eds.), *Quantum Mechanics, scientific perspectives on divine action*, Vatican City State: Vatican Observatory, vi.

[9] Prigogine, Ilya (1980), *From being to becoming*, San Fransisco: W.H. Freedman and Co., 214.

inception to the present. Can the data resulting from measurement, and the properties of separated parts of a system, be given a realist interpretation as classical science had routinely allowed, or must we settle for a positivist or an instrumentalist interpretation – or even an anti-realist interpretation? (Russell 2001, vi)

The increased limitation of deterministic laws means that we go from a universe that is closed, in which all is given, to a new one that is open to fluctuations, to innovations. Classical science was an attempt to go beyond the world of appearances, to reach a timeless world of supreme rationality. The Belgian Nobel prize winner Ilya Prigogine (1980, 215) states in his closing paragraph: "But perhaps there is a more subtle form of reality that involves both laws and processes, time and eternity….. (At present) we still cannot predict where this new chapter of human history will lead, but what is certain at this point is that it has generated a new dialogue between nature and man".

6. *The problem of emergence*

The problem of the origin of the physical universe lies on the boundary of science. Indeed, many scientists would say it lies beyond the scope of science altogether. Nevertheless, there have recently been serious attempts to understand how the universe could have appeared from nothing without violating any physical law. But how can something come into existence uncaused?

The law of cause and effect, which is so solidly rooted in the ground of daily experience, fails in the world of the quantum. Spontaneous change is part of this world. It has become fashionable to apply quantum physics not only to the microworld of atoms, but to the entire universe, a subject known as quantum cosmology. These applications are tentative and extremely speculative, but they lead to a provocative possibility. It is no longer entirely absurd to imagine that the universe came into existence spontaneously from nothing as a result of a quantum process (Davies 1989, 4-5).

Paul Davies, a physicist well-known for explaining the significance of advanced scientific ideas in simple language, addresses the questions: How can the universe, having come into being, subsequently bring into existence totally new things by following the laws of nature? Put another way: What is the source of the universe's creative potency? (Davies 1989, 6) He answers these questions by accepting that the universe can be understood by the application of the scientific method. He is convinced that the organizational principles needed to supplement the laws of physics are likely to be forthcoming as a result of new approaches to research and new ways of looking at complexity in nature. He believes that science is in principle able to explain the existence of complexity and organization at all levels, including human consciousness, though only by embracing 'higher-level' laws (Davies 1989, 203).

Davies (1989, 203) concludes: 'The very fact that the universe is creative, and that the laws have permitted complex structures to emerge and develop to the point of consciousness - in other words, that the universe has organized its own self-awareness - is for me powerful evidence that there is 'something going on' behind it all. The impression of design is overwhelming. Science may explain all the processes whereby the universe evolves its own destiny, but that still leaves room for there to be a meaning behind existence'.

7. *The miraculous world*

The creation of the universe is usually envisaged as an abrupt event that took place in the remote past. This picture resembles the biblical account of creation (Gen 1:1) and is reinforced by the scientific conception of a Big Bang. Cosmologists believe that immediately after the Big Bang, the universe was in an essentially featureless state, and that all the miraculous structures and complexities of the physical world we see today somehow emerged afterwards (Davies 1989, 1).

Since the Renaissance, scientists started to believe that there is an objective reality beyond our experiences. Science, with its reliance on observational data and logic, was viewed as the best means of acquiring truth about this objective reality. By this view God's interaction and upholding of the physical world by his Word, was gradually removed from the world. Man sought to reinterpret the universe according to his own standards, assigning new meaning to the world and transforming it to suit his own purpose.

Descartes had viewed man as a duality, consisting of a physical body controlled by an immaterial mind or soul. As to the question of how an immaterial soul or mind would interact with a physical body, Descartes asserted that God brought about this interaction similarly as God who is spirit, creates and upholds the physical world. With the success of the sciences since the Renaissance, the mind came to be regarded merely as a part of the physical body. This materialistic view of man was reinforced by Darwin's theory of evolution, which postulated that all kind of life had evolved from non-living matter, including mind and consciousness (Byl 2004, 38-39).

Today science is concerned with highly subjective aspects. On a special workshop held at Windsor Castle during September, 2002, the topic was "Fine tuning in Living Systems". This was the second of a series of meetings sponsored by the Templeton Foundation, to examine the question: "Is there evidence of universal purpose in the cosmos?" Physical, biological and cosmological aspects of the *anthropic principle* have been examined. This principle states that the laws of nature must be such as to admit the existence of consciousness in the universe. This principle and the organizing properties of complex systems are considered to supplement the laws of physics and chemistry, and may have directed the emergence of the present world with conscious life.[10]

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[10] Carr, B. J. and Rees, M. J. (2003), 'Fine-tuning in living systems', *International Journal of Astrobiology* 2 (2), 79-86.

8. *The concept of physical time*

The subject of time entered into the earliest written records of mankind.[11] Whereas the Greek philosophers developed systematic geometry, time remained for them something vague and mysterious, a matter for mythology rather than mathematics (Davies 1995, 29). Aristotle's study of motion of bodies led him to appreciate the fundamental importance of time — for him time was motion.[12] The concept of time as an independently existing thing, an entity in its own right, did not emerge until the European medieval age. The orderliness of nature has been recognized by all cultures, but it was only with the rise of modern science that the precise and objective meaning could be given to that orderliness. In the quantification of this orderliness in nature, the role of time turned out to be crucial (Davies 1995, 30).

Dooyeweerd[13] concluded that the common *religious motif* of primitive communities is found in their concept of time. For these people the existence of all living things is seated in the deification of a cyclic flow of time, from birth to death. From Judaism came the western concept of linear time. A central tenet of the Jewish faith was that of the historical process, whereby God's plan for the universe to unfold according to a definite temporal sequence from the definite moment in the past, when the universe was created by God.

History records that it was Galileo who was foremost in establishing time as a fundamental measurable quantity. By measuring the swing of a lamp against the pulse of his wrist, he discovered that its period is independent of the amplitude of the swing. Soon European craftsmen designed ever more precision clockworks. The push for greater precision in measuring time was motivated by navigation and trade: sailors need to know the time accurately to be able to compute their longitude from the positions of stars (Davies 1995, 30).

The crucial position of time in the laws of the universe followed from the work of Newton in the late seventeenth century. Newton's laws of motion gave substance to the hypothesis that material bodies move through space along predictable paths, subject to forces, which accelerate them in accordance with strict mathematical laws. Having discovered what these laws were, Newton was able to calculate the motion of the moon and planets, as well as the paths of projectiles and other earthly bodies. This was a giant advance in human understanding of the physical world, and the beginning of scientific theory as we now understand it (Davies 1995, 31).

Newtonian time is in its very essence mathematical. Newton gave time an abstract existence, independent from nature. It was included in Newton's description of the world merely as a way of keeping track of motion mathematically. Einstein restored time to its place in the heart of nature, as an integral part of the physical world. 'When scientists began to explore the implications of Einstein's time, they made one of the most important discoveries in the history of human thought: that time, and hence all of physical reality, must

[11] Davies, Paul (1995), *About time*, London: Penguin Books 9.

[12] Ross, W.D. (1955), *Aristotle's physics*. Oxford: Clarendon.

[13] Dooyeweerd, H. (1959), *Vernieuwing en bezinning, om het reformatorisch grondbegrip*, Zutphen: J.B.van den Brink & Co., 15.

have had a definite origin in the past. If time is flexible and mutable, as Einstein demonstrated, then it is possible for time to come into existence — and also to pass away again; there can be a beginning and an end to time. Today the origin of time is called "the Big Bang". Religious people refer to the beginning as "the creation"' (Davies 1995, 17).

By establishing time as a fundamentally measurable quantity, time became an abstracted mathematical parameter for scientific and practical purposes. Human life is governed by this time, which is read from watches and clocks. Time as a measurable quantity is thus robbed from much of its original human, psychological and biological content (Davies 1995, 265-278). The cosmos is dynamic, it evolves, it changes in the lapse of time. The world in all its aspects is today different from the world of earlier times. This evolution in time is also recognised by the reformed philosophers Dooyeweerd,[14] Vollenhoven,[15] and Stoker.[16]

9. *Evolutionary perspectives on time*

The flow of time is fundamental to our experiences. It is in terms of this concept of time, abstracted for scientific purposes, that we accept that the present is the key to the past. It is in terms of this time that we then arrive at an instant of about 15 thousand million years ago for the origin of the universe by means of a Big Bang. We accept this event as the beginning of time and read then into this event the origin of natural laws. The acceptance that the present time rate of changes stayed the same from the Big Bang until today, is the only way that a scientific answer can be given to the question of origin of a universe whose history has to be described by the present passing of time. Hereby science accepts the concept of origin for which the evidence is convincing — the universe did not exist from an infinite past.

The concept of linear[17] time implies an arrow of time, pointing from the past to the future and determining the directionality of the sequence of events. In the middle of the nineteenth century the laws of thermodynamics were discovered. Heat always flows unidirectionally from hot to cold. For that reason heat flows from the Sun and stars irretrievably into the depths of space. This will continue until the Sun and stars have burnt all their nuclear fuel and ceased to shine. This running down of the universe is expressed by the second law of thermodynamics in terms of rising entropy, which is, roughly speaking, a measure of the degree of chaos of a system. This law predicts an ultimate

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[14] E.g. Spier, J.M (1953)., *Tijd en Eeuwigheid, Een wijsgerig onderzoek bij het licht van Gods Woord,* Kampen: J.H. Kok; Kalsbeek, L. (1970), *De wijsbegeerte der wetsidee: proeve van een christelijke filosofie.* Amsterdam : Buijten & Schipperheijn. .

[15] Vollenhoven, D.H.Th. (1968), 'Problemen van de tijd in onze kring', in Tol, A. en Bril, K.A. *Vollenhoven als Wijsgeer,* Amsterdam: Buijten & Schipperheijn 1992.

[16] Stoker, H.G (1948), 'Die problematologie van die tydsvorme', *Tydskrif vir Wetenskap en Kuns,* 8(1), 47-61. Stoker, H. G., 'Tydfilosofie', unpublished manuscript 2.1.17 on CD *The academic heritage of Prof. Dr. H. G. Stoker,* on request available from the author.

[17] Linear time implies that the geological rate of changes observed today in nature, was unchanged from the beginning.

thermodynamic equilibrium in a physical system. Applied to the universe as a closed system this means an eventual 'cosmic heat death'.

Biological evolution also introduces an arrow of time into nature, but this arrow points in the direction of increased progress, opposite to the degenerating direction of the second law of thermodynamics. According to biological evolution, life on earth began in the form of primitive micro-organisms, and advanced over time to produce a biosphere of staggering organizational complexity, with millions of intricately structured organisms, superbly adapted to their ecological environment. Biological systems — living beings — are not physically closed systems and therefore the second law of thermodynamics is not applicable.

Darwin himself clearly believed that there is an innate drive in nature towards improvement: 'As natural selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection'.[18] According to Davies (1995, 35), 'although the theory of evolution rejected the idea that God had carefully designed and created each species separately, it left room for a designer God to act in a more subtle way, by directing or guiding the course of evolution over billions of years upwards towards man and maybe beyond'. Progressive thinkers saw evidence in the universe as a whole, not just in the earth's biosphere, of an intrinsic ability for nature to produce order out of chaos. The linear time concept of these philosophers and scientists was one of assured advancement.

Many scientists, who have been influenced by the work of Ilya Prigogine, acknowledge the existence of self-organizing processes in nature, and maintain that advancement towards greater organizational complexity is a universal law-like tendency. Which of these tendencies — advancing complexity or degeneration (rising entropy) due to the second law of thermodynamics — will win in the end depends crucially on the cosmological model adopted (Davies 1995,36).

10. *Conclusion*

It is a founding assumption of science that there is a real world of which we can make sense, and that world includes time. Given a rational universe, we can seek answers also to rational questions about time. We therefore deal with the physical, measurable time as if it is real, a time that flows from the past to the future. Scientifically this abstract physical time had to be applied also to the source of time and to the date on which the universe began, 'if indeed it had a beginning' (Davies 1995, 43).

The idea of the nature, structure and origin of the universe depends on the human being, who has only knowledge about time and natural processes experienced in a passing world. The biblical account of creation in six days suggests, however, that the universe came into existence by a series of discrete

[18] Darwin, C. (1860), *On the origin of species by means of natural selection*, London: John Murray, 2nd ed., 486.

supernatural acts. An earthly being could not envisage the supernatural, creational acts of a transcend, eternal God, who is not immanently part of a temporally world and who, as an eternal Being, is not subject to the passing time of a temporally world. There might have been a sequence in His acts of creation, but that does not imply that He as a transcendental Being would perform his creational acts subjected to the flow of worldly time. This does imply that it is meaningless to relate the duration of the biblical six days of creation to our time in terms of hours, days or even aeons. It also implies that the flow of worldly time started after completion of the six days of supernatural acts.

Human's authority over nature includes the science through which he or she tries to understand the complexity, functionality, rationality and interrelationship of every aspect of God's creation. Today all humans pursue natural sciences together, irrespective their religious beliefs. Consequently, the sovereignty of God with regard to His creation, is not acknowledged by the natural sciences as such, and therefore also not God's authority and goodness, which are the prime ethical characteristics of His personality.

The natural sciences seek to explain all of reality in terms of purely natural processes and entities, subject to currently accepted paradigms and worldviews. The large measure of conceptualisation and imagination, resulting from the scientific approach to reality, does bring forward fascinating new insights on the concealed secrets in natural structures and processes such as the energy principle, the concept of mass, the equivalency of mass and energy, the currently accepted[19] relatedness of space and physical time, the miraculous complexities and unique organisational features of living organisms, the concealed nature of time, the unimaginable extensiveness of a dynamic universe with interrelated structures and complexities, and, above all, the concealed subtle forms of reality of which Davies and other natural philosophers and scientists are convinced.

These subtle forms of reality, which cannot be explained rationally, were already concealed in the views of the Christian Apologists of the 17th century, including Boyle.[20] They saw a proof of an almighty Creator and Providence in the strict regularity and functionality of the 'machinery' of nature (Hooykaas 1997, 6). For Boyle, the immense heavens are a cause to admire God's infinite greatness (Hooykaas 1997, 72). Furthermore, 'God's knowledge infinitely transcends ours; he may be supposed to operate according to the dictates of his own immense wisdom, so why should he have respect to the measure and ease of human understandings?'(Hooykaas 1997, 75) Boyle simply wants to ascertain by means of the senses and intellect how creation operates, even though it turns out only in part to be within the grasp of reason (ibid.). For Boyle all things, at least within the sphere of the physical, are intelligible in principle, but they are not necessary so in reality. All things are intelligible but they are not all

[19] Einstein's acceptance of the constancy of the speed of light everywhere in the universe resulted in a specific relatedness between space and time described by his four dimensional continuum. New evidence may lead to a new view of space and time in the future.

[20] Hooykaas, R. (1997), *Robert Boyle, a study in science and Christian belief*, Lanham:University Press of America, 5-6.

explicable ‘by the dim reason of man’ after the fall. Thus for Boyle there can be facts that we do not yet understand, or will never understand, yet which must be acknowledged as true (Hooykaas 1997, 25).

Believers, also the believing scientists, live daily with and from the Holy Scripture. This contact with Scripture is, however, pre-scientific because it is a religious contact. Scripture reveals to us in this pre-scientific sense, the principle of creation and of the sovereignty of God as well as the dependence of the cosmos on Him. Furthermore, in so far as the universe can be known, it is a revelation of God’s ideas that He realised in his creation of heaven and earth and everything contained therein. But creation is more than revelation. In so far as everything in creation is subject to laws, the whole of creation and all its parts have meaning and purpose. But creation is also more than systems of law-subjects. It is also dynamical real and active, it evolves in time.

Since reality, as revealed by our sciences, is understood from immanent earthly considerations, reality is a closed rational system — it remains an abstract scientific approach rooted in an anthropocentric outlook (Schuurman 2005, 35). If we do take account of the transcendently revealed principle of creation, scientific thought becomes open, recognising objectively from naive experience the gradual, qualitative, modal, individual and fundamental differences in phenomena surrounding us.[21] Then we also recognise the laws by means of which God upholds and guides the development of the universe to the fullness of time, laws that we with our dim reason know very little about. We then also recognise our ethical responsibility to till and keep the earth (Gen 2:15), to glorify the Almighty God for his Wisdom and to love our neighbour (Schuurman 2005, 35).

[21] Stoker, H. G., ‘Calvinism and philosophy’, unpublished manuscript 2.1.19.14, and ‘Calvinistiese wysbegeerte’, unpublished manuscript 2.1.19.8, on CD *The academic heritage of Prof. Dr. H. G. Stoker,* on request available from the author.