God After the Big Bang
Toward a Revision of Classical Theism

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Explaining the origins of the universe has long been a field where religion and science has long contended with each other. Abandoning the claims of classical theism, George Coyne inputs the Darwinian theory of evolution and the process philosophy of Alfred North Whitehead in pointing out the role of God in an evolutionary, intrinsically fertile universe, where chance and necessity interacts in an already creative environment. The result is a scientific and theological justification of a Creator-God, not as the order-giver through a preconceived plan, but as one Who, out of generosity, shares the creative power with finite entities.

Introduction

As generally well known, the texts upon which the Christian belief in the Creator God rest– the two Creation stories of the book of Genesis and Plato's and Aristotle's philosophical cosmologies– date back to about 19 centuries before the Copernican turn and 23 centuries before the Big Bang Theory. So, one may not expect these texts to offer any knowledge of what in the meantime we have come to know, namely (1) that Earth is one of the planets in the solar system, which in turn is only one of the billion solar systems that make up the Galaxy and (2) that the universe consists of billions of such Galaxies. Nonetheless the theistic assumptions of these texts continue to dominate whenever Christian believers attempt to articulate God's role in the creation of the universe that is, because of the Big Bang, is still caught up in a process of accelerated expansion that makes the Galaxies rush apart. In this article I would like to demonstrate one of the basic theistic assumptions that God, as the first cause, on the basis of a preconceived plan, imposes order on the world stands in need of

serious revision, if one is to articulate a doctrine of belief in the Creator that is consonant with our contemporary knowledge of cosmology.

DESTRUCTION OF THE OLD PICTURE OF GOD

Christian cosmology is a harmonization of Jewish thought and Greek cosmology. The picture of the Cosmic God that results from it is still present in the Christian liturgies of the East and the West. The majestic triune God is enthroned above the firmament. A firmament to which He imparts a rotation that, in varied ways, will be communicated to the transparent concentric rings on which the respective planets Saturn, Jupiter, Mars, Venus, Mercury, the Sun and the Moon are attached and which all owe their proper inclination to an angelic or cosmic intelligence (in Aristotle's parlance) who gives a particular twist to their rotation. In this way divine energy is gradually descending down from the highest heaven to the Earth that lies in the center of the heavenly machinery. From God in the highest not only flows down the kinetic force that regulates the earthly rhythms of growth in plants and animals, but also the special energy, termed grace, that animates and renews the souls of humans. It is in this immortal celestial domain, too, that hosts of angels the invisible orders of sovereignties, dominions and thrones incessantly chant the glory of the triune God. With this chant of praise the Christian community joins in whenever in the Eucharist they conclude the solemn preface with the words:

> And so, with Angels and Archangels, with thrones and dominions, and with all the hosts and powers of heaven we sing the hymn of your glory: Holy, Holy, Holy, Lord God of hosts. Heaven and earth are full of your glory. Hosanna in the highest.

As soon as Copernicus, a Polish cleric and canon of the Roman Catholic Church, demonstrated in 1543 how much simpler the picture of the world would be if the Earth with the other planets revolve about the Sun instead of, the heavenly

machinery orbiting the earth, this cosmic liturgy suddenly lost its age-old foundation. Three generations later, Galileo through his observations of the heavenly bodies would furthermore prove that there was not such a thing as the indestructible quintessence—previously thought to be a fifth substance in addition to the four earthly elements out of which (in the Aristotelian tradition) the celestial spheres, the stars and the planets, were made. It became soon evident that the whole celestial domain consisted of merely physical matter and was, just like the entities on earth, ruled by the same mechanical laws of motion. This insight was finally corroborated by Isaac Newton when in 1672 he formulated the universal law of gravity. This law not only accurately explained why an object dropped from a height on earth would fall to the ground, but also explained the rhythm that the planets and the earth adopt in their annual journey around the Sun.

Within the framework of the heliocentric system, however, Newton succeeded in resuscitating the belief in the Creator. In his system, nothing of the rotating celestial spheres remained intact. For him, the sole force of gravity that pierces the void brings about the unchangeable rhythm of the planetary motions. As such, this phenomenon bore witness to the might of the Creator who with the instrumentality of gravity kept the celestial bodies on their fixed orbits. In addition that selfsame rhythm was, ensured by the unchangeable coordinates of absolute space and absolute time, which so to speak, formed the medium and 'organ' through which the Eternal One regulated, and imposed His dominion on, the mechanics of the universe.

Scientific research, however, did not stand still. From 1905 to 1916 Albert Einstein developed the Special and General Theory of Relativity that blew Newton's absolute coordinates of space and time. In Special Theory of Relativity, Einstein introduced his new absolute magnitude: the speed of light which is always measured as 300.000 km/sec no matter the speed of the source emitting it; no matter, also, the speed of the platform from which that speed of light is being measured. The more such a platform approaches the speed of light, the more the rulers used to measure the distances it contracted, and the clocks used to measure time sequences slowed down, so that on every occasion the selfsame speed of light is

registered. The speed of light, in other words, relativizes the allegedly absolute notions of space and time that now become variable. In his General Theory of Relativity, Einstein further demonstrated that gravity— which Newton said could not possibly come forth from matter— is generated by the accumulation of mass and energy. This accumulation leads to the formation of the gravitational fields through which space is being curved. In this scenario the planets follow a more or less straight path in the hollow space that is curved by the mass of the Sun.

It did not take long before the insight into the warped makeup of space-time was to result in the flabbergasting idea that the universe as such is subject to warping. Einstein's equations of the geometry of the universe predicted a universe that is not static but would either contract or expand. However, in order to obtain a universe in balance, Einstein mutilated his elegant equations by introducing a cosmological constant. But this maneuver was contested. Independently of each other, Russian mathematician Alexander Friedmann and Belgian priest Georges Lemaître, professor of astronomy at the Catholic University Louvain, demonstrated that the cosmological constant was not necessary and that Einstein's original calculations gave evidence of an expanding universe. In 1929, Einstein refused to accept this view until Edwin Hubble, proved that the universe was expanding. Hubble worked with one of the strongest telescopes of his era at the Mount Wilson Observatory in California. This allowed him to look into galaxies outside our Milky Way that until then were thought to be spiraling clouds of gas (nebulae). He was able to identify myriads of stars in them and get a picture of their chemistry. When examining the spectra of stars in faraway galaxies he discovered something astonishing: in these spectra "there were the same characteristic sets of missing colors as for stars in our own galaxy, but they were all shifted by the same relative amount toward the red end of the spectrum."[1] This meant that the galaxies were receding from us and from each other. Hubble even observe that the more distant a galaxy, the faster it is receding. If a galaxy located at a distance of 50

[1] Stephen Hawking, *A Brief History of Time,* (London: Bantam Books, 1989), 40.

million light years is receding at a certain speed, a galaxy at twice that distance will recede at twice that speed. When he learned of these findings, Einstein confessed that his introduction of a cosmological constant was the blunder of his life.

Hubble's discovery confirmed the Big Bang Theory that Lemaître had proposed in 1927. Lemaître's reasoning was simple. When running the expanding universe back in time, one had to eventually reach a point from where it all started: the 'primeval atom' that gave rise to a terrific fireball from which not only the elementary particles came forth that later formed the atoms, and finally the clouds of gas and dust out of which the stars were born, but also the explosive expansion of space and time that continues today. Lemaître's picture of the Big Bang explosion was reminiscent of the first creation story in the Book of Genesis, according to which God separated light from darkness. Christian believers saw in it the affirmation of the might of the Creator who, as it was confessed, called forth all things out of nothing.

Yet, a new problem arose. Einstein's Theory of Relativity perfectly predicts the behavior of large bodies in the macrocosm, but breaks down at the minuscule 'initial singularity,' when the universe had zero size. To describe the events close to the 'initial singularity' one must have recourse to quantum physics. Lemaître, to be sure, already had some idea about the mysterious realm of the quanta, but it still took some time before a theory was developed that could shed light on the events in the early universe. This theory was the Hot Big Bang Theory propounded in the famous "Alpher–Bethe–Gamow paper," or αβγ paper, created by Ralph Alpher, then a physics PhD student, and his advisor George Gamow, published in the *Physical Review* in April 1948. According to this theory the Big Bang explosion released a tremendous amount of heat. Whenever the universe doubled its volume, its temperature fell by half. This continuous drop in temperature gradually occasioned various symmetry breaking. These symmetry breaking had far reaching consequences. At a certain moment this led to the preponderance of matter over antimatter (prior to it matter particles, such as electrons and quarks, and their related counterparts — positrons and anti-quarks — were caught up in a relentless process of mutual annihilation, with no chance left for

stable matter to come out of it). Similar symmetry breakings caused the successive splitting off of the four forces – gravity, the strong nuclear force, the weak nuclear force, and the electromagnetic force — separations that all took place at lower temperatures. By means of these procedures scientists were able to reconstruct the formation of atoms. Almost three minutes after the Big Bang, atomic nuclei were formed (25% were helium nuclei; 75% were hydrogen nuclei). Yet, it would still take 380,000 years before these nuclei could capture electrons, so that complete helium atoms and hydrogen atoms were born. These atoms coalesced into molecules, and after millions of years would eventually give rise to spiraling clouds of gas and dust. When these imploded under the impact of the gravitational force, nuclear fusions took place in their inner core: hydrogen was burnt into helium, the procedure that makes the stars shine and produce energy.

The Hot Big Bang Theory offers an impressive scenario for the formation of the universe, but is rather silent about the precise beginning of the Bang, the realm of pure quanta. Detailed studies of the quanta, however, show that their behavior is in a sense lawless. In 1926, Heisenberg launched the principle of uncertainty: if one succeeds in measuring the position of a quantum (an electron, for example), then its velocity becomes uncertain and vice versa. The mysterious world of the quanta seems to be ruled by chance and contingency, so that a clear prediction of what precisely is going to happen becomes impossible. Only a probability calculus can tell us what the probable outcome of empirical testing will be. Particles may split into twin particles that, although traveling light years apart, may through instantaneous communication (faster than the speed of light) make out how to react to certain circumstances. Moreover, particles sometimes behave as particle points and sometimes as waves. And their wave behavior may be such that interference occurs in which undulating waves either fortify each other or cancel each other out. In short, there is apparently no rule to predict the reactions of the quanta. When, from this background of indeterminacy, scientists set out to probe into the very 'beginning' of the universe, they discovered that no clear-cut formula could be devised that determines the 'mechanism' of the Big Bang. This explains why Stephen Hawking, in his book

The Grand Design (2010) takes it for granted that 'in the beginning' quantum fluctuations must have given rise to the splitting off of several mini-universes which after many exploratory attempts would have developed their own sets of natural laws. Trial and error are just part of the game. Chance and strokes of luck rather than the implementation of some pre-conceived design in the mind of the Creator seem to have led to the formation of multiple universes — our universe being just one of them. For Hawking, the universe spontaneously emerged 'out of nothing' without any creator steering it. Belief in the Creator God had definitely shrunk to the zero point.

The situation can be compared to the faith crisis occasioned by Darwin's theory of evolution. Indeed, in 1859 Charles Darwin showed that the evolution of the species rested on contingent factors: the species changed the makeup of their organisms through steady adaptation to the natural milieu. Only those organisms that had successfully coped with the challenges of their new biotopes were fit to pass on their heritable genetic variation to the next generations, whereas the others were doomed to stagnate or to disappear. Here, too, it was a fruitless enterprise to look for a scenario in which God's overall planning would have steered the evolution of higher species from lower ones. Such an explanation would not do justice to the random chance factors that were involved in the process of evolution. The concrete ways in which the amazing biodiversity originated on earth seem to defy any preconceived design, since many contingent factors are involved in this age-long proliferation: such as the species' urge for survival in changing biotopes, or their need to protect themselves against predators. This brings me to the disputed question of *intelligent design.*

Intelligent Design

The seemingly random emergence of higher species from the lower ones threw many Christians believers into confusion. This confusion explains the rise of the movement of Creationism, which was in the first place a reaction against Darwin's theory of evolution. The model the creationists had in mind was 'creation in

six days.' In this model God separately called forth the various species of plants and trees and of the animal kingdom, and finally the human being made in His image. Creationism strictly posits God's personal intervention in the process by which each species comes into existence. Yet, apparently because this schema was too simplistic, its adherents had after a while recourse to the notion of *intelligent design*, whereby the starting point is God's preconceived plan that, in a second move, he must have gradually implemented so as to bring about the transition from less complex to more complex species.

The term *'intelligent design'* acquired a negative reputation in scientific circles because of the use and abuse made of it by the American Discovery Institute, a politically conservative think tank that is home to an anti-Darwin lobby. The Seattle-based Discovery Institute was founded in 1990 with the purpose of propagating a scientific underpinning for Creationism so as to discredit Darwin's theory of evolution; it holds that "certain features of the universe and of living things are best explained by an intelligent cause, not an undirected process such as natural selection."[2] Its advocates attempted to introduce their theory in public school biology curricula. "Their overall goal is to defeat the materialist world view represented by the theory of evolution in favor of a science consonant with Christian and theistic convictions."[3] So, they lobbied to have the theory of evolution replaced with the doctrine of *intelligent design* in the school curricula, or at least to have the two theories taught side-by-side as equally valid. The movement is very influential in the USA; due to its solid funding it is able to attract interested scientists for the purpose of publishing books that seek to demonstrate alleged weaknesses and lacunas in Darwin's theory, such as the missing links in fossil records, or the improbable fact that irreducibly complex systems could have emerged from successive modifications of a precursor system.[4]

[2] "Intelligent Design," *Wikipedia*, accessed June 15, 2012, http://en.wikipedia.org /wiki/Intelligent_design.

[3] Ibid.

[4] See Michael Behe, *Darwin's Black Box, The Biochemical Challenge to Evolution* (New York: The Free Press, 1996), 39.

These publications are not always taken seriously in scientific circles. In his book *The God Delusion,* Richard Dawkins, a harsh proponent of neo-Darwinism, ridicules, for example, the argument as from half an eye (a less complex system) by no means a whole eye (an irreducibly complex system) could be formed. "True," he says, "the eye of a flatworm already discerns light from shadow, whereas the eye of a *Nautilus,* only sees vague forms, which makes it an intermediary between a flatworm's and a human being's eyesight. But even then it is better to have half an eye than no eye at all. For once half an eye happens to be given; it becomes a candidate for climbing the steep cliff of the 'improbable' mount of evolution and turn into a whole eye like ours. Why, for heavens' sake, should there right away come an 'irreducibly complex system' (a whole eye), as the adherents of *intelligent design* would like to have it?"[5] Thus it was for Dawkins.

The main purpose of this article is not, however, to take a position in the above controversy. It is more important to find a way out of the deadlock between creationists and Darwinists. Robert Asher, a paleontologist who himself has religious convictions, can stand here as a model. He reminds both the advocates of *intelligent design* and the evolutionists of the fact that the God idea they embrace or reject is entirely one-sided. As if the Creator God would not be able to call forth a self-evolving creation. From his study of fossils, Asher has come to realize that the amazing biodiversity on earth cannot possibly be the result of some preconceived divine plan. In order for this biodiversity to emerge, contingent factors must have come into play such as the obstacles the species had to overcome in order to survive. Time and again their organisms had to adapt to changing biotopes; they often had to develop refined characteristics (stronger wings or shells) to make it possible for them to withstand the attacks of the predators. Only in retrospect may these biological adaptations display some directionality; but it would be nonsense, Asher maintains, to connect this 'directionality' to some preconceived plan. This has to do with a type of 'order' born from the apparently random working of things.

[5] Richard Dawkins, *The God Delusion* (London: Black Swan, 2007), 150.

In short, Asher asks the question as to why we think God must act in the way we think He should act. He invites both parties to examine the extent to which their (embraced or rejected) notion of design has an anthropocentric ring about it. Who are we to impose our notion of design on the ineffable dealings of the Creator? He wrote:

> The equations 'purpose— God' and 'randomness = atheism' [have a common origin. They] are contingent upon some preconceived notion of order [...] The fact that we find it difficult to appreciate the creative power of apparent randomness does not mean that God suffers from this problem [...] Requiring that God's style of invention has to resemble our own, as do many creationists and atheists alike, seems extraordinarily presumptuous and vain. Darwinism must be God's method of action.[6]

Moreover, Darwinian evolution is, strictly speaking, not a random process; it is steered by a stubborn will to survive. The novel biological formations are indicative of a struggle for life that generates its own creative power.

EVOLUTION OF THE COSMOS

The discussion about *intelligent design* is not limited to the origin of the species. It comprises also the evolution of the whole cosmos. This becomes evident from the controversy between the American Jesuit George Coyne and Cardinal Christoph Schönborn of Vienna. During a tour in the United States Schönborn published a column in the *New York Times* on 7 July 2005. In this column Schönborn sided with the American advocates of *intelligent design* and claimed that neo-Darwinism and the theory of multiple universes are incompatible with the church's belief in God's purposeful action. I quote from this column:

[6] Robert Asher, *Evolution and Belief. Confessions of a Religious Paleontologist* (Cambridge: Cambridge University Press, 2012), 13-14.

> In the 19th century, the First Vatican Council taught a world newly enthralled by the 'death of God' that by the use of reason alone mankind could come to know the reality of the Uncaused Cause, the First Mover, the God of the philosophers. Now at the beginning of the 21st century, faced with scientific claims like neo-Darwinism and the multiverse hypothesis in cosmology invented to avoid the overwhelming evidence for purpose and design found in modern science, the Catholic Church will again defend human reason by proclaiming that the immanent design evident in nature is real. Scientific theories that try to explain away the appearance of design as the result of 'chance and necessity' are not scientific at all, but, as John Paul II put it, an abdication of human intelligence.[7]

The aim of the Cardinal was apparently to remove any doubt about the existence of God. But Coyne, then the director of the Vatican Observatory at Castel Gandolfo, took issue with Schönborn's apparent endorsement of the *'intelligent design'* theory, and asserted that the critics of evolution were underestimating God's willingness to give 'freedom' to the processes of nature. He rather saw the evidence of cosmic evolution as a welcome opportunity for Christians to deepen their faith in the Creator God. Coyne's indignation is understandable if one realizes the extent to which Schönborn's reference to the First Vatican Council is in a sense obsolete (it took place in 1869 and 1870: almost sixty years before the spreading of the Big Bang Theory) and how selective is his recourse to modern science (which he apparently limits to what Newton had to say about *intelligent design).*

In his response, Coyne does not dwell on the theory of the multiple universes. He immediately turns to cosmic evolution, which — comparable to Darwin's vision of growth in complexity — led to the formation of the solar system and to the production (in

[7] Christoph Schönborn, "Finding Design in Nature," July 7, 2005, accessed December 17, 2012, http://www.nytimes.com/2005/07/07/opinion/07schonborn.html.

the stars) of the chemical elements needed for the emergence of life, and finally intelligent life on earth. He was confident that his view on cosmic evolution matched with recent papal teaching. Right from the start he mentions that Pope John Paul II, in an epoch-making declaration to the *Pontifical Academy of Science* in 1996, had stated that "evolution is not a mere hypothesis"; and remarks that, in the same allocution, the Pope had invited theologians "to draw reasonable implications for religious belief from that conclusion."[8] In line with this, Coyne will give his faith-inspired reading of cosmic evolution, a reading that is based on scientific facts.

Coyne takes his lead from Schönborn's derogatory statement about the theory of evolution, namely that it tries to explain away the appearance of design as the result of 'chance and necessity.' He stresses that it is nonsense to pit chance against necessity and vice versa. What really matters is the enormous 'fertility' of the universe[9] — his term for the intrinsic creativity of the cosmos. It is only from this background that one is able to appreciate the subtle interplay between chance (stroke of good luck) and necessity (the working of the laws of nature). In Coyne's words: "The classical question as to whether the human being came about by chance, and so has no need of God, or by necessity, and so through the action of a designer God, is no longer valid. And so any attempt to answer it is doomed to failure. The fertility of the universe, now well established by science, is an essential ingredient, and the meaning of chance and necessity must be seen in light of that fertility. Chance processes and necessary processes are continuously interacting in a universe that is 13.7 x 1 billion years old and contains trillions and trillions of stars. Those stars as they 'live' and 'die' release to the universe the chemical abundance of the elements necessary for life. In their thermonuclear furnaces stars convert the lighter elements [hydrogen and helium] into the

[8] George Coyne, "God's Chance Creation," *The Tablet* August 6, 2005, accessed June 20, 2012, http://www.thetablet.co.uk/article/1027 .

[9] In his book co-edited with A. Omizzolo, George Coyne-Allessandro Omizzolo, *Wayfarers in the Cosmos: The Human Quest for Meaning* (New York: Crossroad Publications, 2002). Coyne did not yet use the term 'fertility of the universe.'

heavier elements [carbon, oxygen, iron]. There is no other way, for instance, to have the abundance of carbon necessary to make a toenail than through the thermonuclear processes in stars. We are all literally born of stardust."[10]

To illustrate how chance and necessity work in tandem Coyne gives the example of how a hydrogen molecule forms: "two hydrogen atoms meet in the early universe. By necessity (the laws of chemical combination) they are destined to become a hydrogen molecule. But by chance, the temperature and pressure conditions at that moment are not correct for them to combine. And so they wander through the universe until they finally do combine. And there are trillions and trillions of such atoms doing the same thing. Of course, by the interaction of chance and necessity, many hydrogen molecules are formed and eventually many of them combine with oxygen to make water, and so on, until we have very complex molecules and eventually the most complicated organism that science knows: the human brain."[11] The same interaction of chance and necessity was also at work in the formation of the atoms. It took almost 380,000 years after the Big Bang before the atomic nuclei were able to capture their electrons, for only by then had the universe expanded enough for its temperature to drop so as to make the combination possible.

The interaction of chance and necessity is apparently spread over billions of years starting from the Big Bang, 13.7 billion years ago. It led to a growing complexity of chemical elements, which in turn gave a certain intrinsic natural directionality to the evolutionary process. The more complex an organism becomes the more determined is its future. "This does not necessarily mean, however," Coyne continues, "that there need be a person directing the process, nor that the process is necessarily an 'unguided, unplanned process of random variation and natural selection' as Cardinal Schönborn describes it. It is precisely the fertility of the universe and the interaction of chance and necessity in that

[10] Coyne, "God's Chance Creation."
[11] Ibid.

universe which are responsible for the directionality. Thus far the story of science."[12]

The next question then is: where does the Creator God feature in this scientific scenario? Coyne's answer is simple: "If one believes in God's loving relationship with His creation and especially with the human beings made in His image and likeness, and if one also respects the science described above, then there are marvelous opportunities to renew one's faith in God's relationship to his creation."[13]

The Input of Process Philosophy

Although Coyne nowhere mentions this, he appropriates in fact an insight developed by Alfred North Whitehead, the founder of Process Philosophy. In the closing pages of his 1929 book *Process and Reality,* Whitehead distances himself from what he calls the unilaterally ruling God. He prefers to speak about the 'Galilean God of endearment' who allows Himself to be influenced and touched by what is happening in the world. He writes: "When the Western world accepted Christianity, Caesar conquered; and the received text of Western theology was edited by his lawyers. [...] The Church gave unto God the attributes which exclusively belonged to Caesar." Contrasting with this view is the Galilean notion of God. "It does not emphasize the ruling Caesar, or the ruthless moralist, or the unmoved mover. It dwells upon the tender elements in the world that slowly and in quietness operate by love. [...] Love neither rules, nor is it unmoved."[14] In a similar vein Coyne brings up the idea of a tender God. From what we now know about the evolution of the cosmos, he says, "we should move away from the notion of a dictator God, or a designer God, a Newtonian God who made the universe as a watch that ticks along regularly. Perhaps God should be seen more as a parent or as one who speaks encouraging and sustaining words. Scripture is very rich in these thoughts."[15]

[12] Ibid.
[13] Ibid.
[14] Whitehead, *Process and Reality,* 404.
[15] Coyne, "God's Chance Creation,"

In less poetic terms: we ought to imagine God as the One who is so generous that he allows the creation to share in His own creative inventiveness. This is exactly what Process Philosophy propounds. According to this philosophy, creativity is, to be sure, first and foremost exemplified in God, but as soon as God calls forth the universe, this universe in turn develops a stupendous creativity that causes ever-new things to emerge.

Whitehead is reported to have said that the whole of Western philosophy, his own philosophy included, is but a footnote to Plato. This appreciative remark refers in the first place to what Plato in his dialogue *Timaeus* has to say about the creation of the cosmos. For Plato, the Creator acts out of pure generosity. The entities he is going to create "will be as much as possible similar to him."[16] In this statement one recognizes the design approach. God, the Demiurge, fixes his gaze at the eternal ideas after which the material world is to be modeled. Yet, in a further move, Plato relativizes the design approach by focusing on the role played by the 'World Soul' in bringing about order out of chaos. The 'World Soul,' carefully constructed by the Demiurge on the basis of mathematical and musical proportions, acts upon the world as the immanently organizing principle; it lures matter into welcoming the imprint of the mathematical and geometrical forms. Thanks to this lure, ever new and unexpected constellations of order come into being.

Whitehead highly appreciates this vision of an organic unfolding of the cosmos. He opines that Plato would "not have been surprised at the modern quantum theory" and at the modern notion of the evolution of matter.[17] In Whitehead's Process Cosmology, too, the whole focus is on the principle of creativity. In it, the Creator God is, to be sure, the highest creative instance, but not the sole creative instance; he allows the cosmos to develop its own intrinsic creativity. So, too, is it for Coyne: "God in His infinite freedom, continuously creates a world that reflects that freedom at all levels of the evolutionary process to greater and

[16] Plato, *Timaeus*, 29
[17] Whitehead, *Process* 113-114.

greater complexity. God alloweds the world be what it will be in its continuous evolution. He is not continually intervening, but rather allows, participates, loves."[18] This implies that God takes the risk of allowing the creative process to take its own course because of the many chance processes involved in it. We should never forget that we, human beings, are the outcome of so many improbable cosmic events that took place billions and billions of years ago. We are late-comers in an evolutionary process that is so extraordinary that it should fill us with feelings of awe.

Conclusion

As a summary, we have seen the believing paleontologist Robert Asher, in his study of the theory of evolution, abandoning the idea of a preconceived plan (intelligent design). For him, Darwinism must be God's method of action. Only looked at in retrospect can one discern some 'directionality' in the species' biological adaptations to their environment. This 'directionality' is, definitely, contingent; it could have taken another direction than it actually did.

George Coyne goes a step further. He expands the notion of evolution to the cosmos as such. Indeed, from his study of the stars in the Vatican observatory at Castel Gandolfo he knows that the chemical elements that were needed for the emergence of biological and intelligent life — carbon, oxygen, iron — were fabricated in the stars. Just like Robert Asher he refuses to read this event as the unfolding of some divine preconceived plan, since in it, too, contingent facts are involved (our sun being a second or third generation star). Instead, he interprets these contingent facts as resulting from an interplay of chance and necessity. From all this he concludes that the universe must have been endowed with a fertility of its own. This in turn, allows him to confess his faith in God who out of pure generosity allows the universe to share in his creativity, that is: to develop an intrinsic creativity that makes it work in the likeness of God.

[18] Coyne, "God's Chance Creation."

This view is no longer that of classical theism. In classical theism, God is conceived of as the divine planner who (1) imposes his patterns of order on the universe. We see this model clearly in the manner in which God, in the priestly version of the creation myth in Genesis, creates order out of chaos. Further, in classical theism God (2) intervenes in the creation by steering its further detailed development, an aspect that is technically termed: God's continuous creation.

The deviation from classical theism does not lie in the fact that pure chance would replace the role of the Creator, so that God would withdraw from the scene (this is by no means Coyne's thesis). The deviation rather lies in the fact that the cosmos is seen as endowed with an intrinsic creativity instead of appearing as a passive agent that receives its orders from outside itself. When, in an interview Coyne was asked to describe God's role in an evolutionary universe, he answered: "I think the role for God in an evolutionary universe is an extremely rich concept. I think the God of an evolutionary universe — a universe that has a spontaneity to it, that has a dynamism to it, that has a development to it, and an uncertainty to it — that is a much richer God to me than a God of a deterministic universe, a universe that's predetermined. Because God to me — an essential characteristic for God – is freedom and spontaneity. And I believe that a universe participating in that freedom and spontaneity is an evolutionary universe." [19]

This thesis rests on a sound methodology whose ramifications are enormous. For Coyne, the intrinsic creativity ('fertility') of the universe is a scientific fact. As such, this view can be shared by other scientists. Yet, to link this intrinsic creativity to the generosity of a Creator God, is a philosophical or theological interpretation. So, one might expect that non-believing scientists will reject it altogether. For Coyne, however, his option is clear. He uses the scientific fact of the intrinsic creativity of the universe to deepen his faith in God – in a God who is now specified as a generous God, one who lets 'finite' (non-divine) entities share in His marvelous creativity.

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[19] Coyne, "God's Chance Creation."