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Fitness of the Universe for a Second Genesis: Is it Compatible with Science and Christianity?¹

The two questions implied in the subtitle require special attention: the compatibility of a Second Genesis with science is the subject matter of astrobiology, while the compatibility of a Second Genesis with religious belief, especially with Christian belief, lies within the domain of natural theology. Christianity inherited the simplicity of Jewish theology. Monotheism does not present us with any particular stumbling stone for incorporating the emergence of life beyond the Earth. The concept of the fitness of the cosmos for the origin, evolution and distribution of life is relevant for our discussion: the American scientist and philosopher Lawrence Joseph Henderson introduced this concept in science at the beginning of the twentieth century within a more limited scope. This issue has implications on theoretical and moral philosophy, but we are particularly concerned with implications that astrobiology may present to natural theology. The topic of the relationships between science and religion has been discussed in depth particularly since the Enlightenment. Our discussion will remain within the natural boundary of science. We are concerned with the question of whether the evolution of intelligent behaviour is inevitable, given what we know from the new science of astrobiology.

Keywords: astrobiology, solar system exploration, divine action, Christianity, convergence in science.

1. A Second Genesis, or the origin of life elsewhere in the universe

In his book *Religion and Science* Bertrand Russell isolated the main problem at the basis of the question whether our universe is fit for the emergence and evolution of life. At a time when Alexander Ivanovich Oparin was struggling to understand the origin of life on Earth, Russell wrote:²

The three centuries that have elapsed since the Giordano Bruno suffered

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2 Russell, B. *Religion and Science*, New York: Dover (1995).

martyrdom for believing in the plurality of worlds have changed our conception of the universe almost beyond description, but they have not brought us appreciably nearer to understanding the relation of life to the universe.

Astrobiology is a broad discipline that can guide us into an understanding of life in the universe. In fact, it is the correct tool for the search for answers that science can provide regarding the question of the fitness of the universe for the emergence and evolution of life. In this context we can attempt to formulate questions that are of interest beyond science: Does complex chemistry offer evidence of purpose? The intimately related questions of the anthropic principle and fine-tuning in living systems³ are ones that would be simpler to understand with more than a single Genesis.

On the other hand, our religious traditions go back to Jewish theology: there is a sole omnipotent God who created heaven and earth, and subsequently life on earth. This view of our origins has traditionally been referred to as (a 'first') Genesis. But revelation through the scriptures never raises directly the question of the plurality of inhabited worlds. There is no incompatibility between religious tradition and the possibility that we may not be alone in the universe. What is exciting about the emergence of the new science of astrobiology is that we can explore the possibility that the evolution of intelligent behaviour may be inevitable in an evolving cosmos. We shall refer to the possibility of life originating elsewhere in the universe as a 'Second Genesis'.⁴

An aspect of these reflections should be highlighted from the beginning: Our lives are short and we crave for an answer to the question, Are we alone in the universe? No intelligent signals have been identified after almost half a century of searching for life in the universe. This investigation has been carried out through windows of the electromagnetic spectrum. Nevertheless it should be emphasised that considerable technological progress has been achieved in the techniques being used since the SETI project began in the middle of last century. But technology has not been the only field of the space sciences that has progressed in recent years. The exploration of the solar system has also been remarkable with a fleet of missions that are capable of detecting microscopic life.

The search for extraterrestrial life was attempted for the first time on the surface of Mars a quarter of a century ago. The Viking missions were capable of detecting microbial life. Sadly, the results were not convincing to most sci-

3 Chela-Flores, J. 'Fitness of the cosmos for the origin and evolution of life: from biochemical fine-tuning to the Anthropic Principle', in preparation (2005); for a preliminary version cf., Chela-Flores, J. Evolution of intelligent behavior: Does complex chemistry offer evidence of purpose? (2003), <http://www.templeton.org/biochem-finetuning/participants.html>

4 McKay, C.P. 'The search for a Second Genesis in our Solar System', In Chela-Flores, J., Owen, T. & Raulin, F. (eds.) *The First Steps of Life in the Universe*, Dordrecht: Kluwer Academic Publishers (2001), pp. 269-277.

entists. The search still continues today with Mars being the present target of several space missions from NASA, ESA and Japan.

Yet given the harsh conditions for the survival of extremophilic micro-organisms on the Red Planet, the best digging equipment with present technology is still unable to probe as far as the more likely sites, deep underground, where we expect abundant liquid water to be present.

2. Is the science of biology the right tool to discuss a Second Genesis?

In order to consider the question whether a Second Genesis is possible, we should first decide if the science of biology would be the right tool to apply in order to find out whether there is life anywhere in the universe. Indeed, some issues have been discussed in the past regarding the universal nature of biology in general, and biochemistry in particular. Firstly, life may be a cosmic imperative.⁵ A somewhat different approach is due to Francis Crick:⁶ In the 'directed panspermia' hypothesis life can emerge in some solar systems by directly sending microbial organisms to barren planetary or satellite environments.

Secondly, multicellular life may be a rare phenomenon in the cosmos, although the existence of microbial life may still be widespread.⁷ Finally, a third related issue is the possibility that evolution of intelligent behaviour may be just a question of time (and preservation of steady planetary conditions), and hence ubiquitous in the universe. Darwin's theory of evolution is assumed to be the only theory that can adequately account for the phenomena that we associate with life anywhere in the universe.⁸

We argue in favour of the inevitability of the origin and evolution of life. We assume that Darwinian evolution is a universal process and that the role of contingency has to be seen in the restricted context of parallelism and evolutionary convergence.⁹ Convergence is not restricted to biology, but it may also be extended to other realms of science. The question, What would be conserved if the tape of evolution were played twice? has been raised repeatedly in the

5 De Duve, C. *Vital Dust. Life as a cosmic imperative*, New York: Basic Books, A Division of Harper-Collins Publishers (1995), pp. 296-297.

6 Crick, F. *Life Itself its origin and nature*, London, Macdonald (1981).

7 Ward, P.D. & Brownlee, D. *Rare Earth: Why Complex Life is Uncommon in the Universe*, New York: Copernicus (2000).

8 Dawkins, R. 'Universal Darwinism', In Bendall, D.S. (ed.) *Evolution from molecules to men*, London: Cambridge University Press (1983), pp. 403-425.

9 Akindahunsi, A. A. & Chela-Flores, J. 'On the question of convergent evolution in biochemistry', In Seckbach, J., Chela-Flores, J., Owen, T. & Raulin, F. (eds.) *Life in the universe: from the Miller experiment to the search for life on other worlds*, Dordrecht: Kluwer Academic Publishers (2004), in press.

past.¹⁰ Since all forms of life known to us are terrestrial organisms, it is relevant to the question of whether the science of biology is of universal validity.¹¹

Independent of historical contingency, natural selection is powerful enough for organisms living in similar environments to be shaped to similar ends. For this reason, it is important to document the phenomenon of evolutionary convergence at all levels, in the ascent from stardust to brain evolution. In particular, documenting evolutionary convergence at the molecular level is the first step in this direction. Our examples militate in favour of assuming that, to a certain extent and in certain conditions, natural selection may be stronger than chance.¹² We raise the question of the universality of biochemistry, a science supporting chemical evolution.

3. Could biochemical fine-tuning be responsible for a Second Genesis?

We have assumed that natural selection seems to be powerful enough to shape terrestrial organisms to similar ends, independent of historical contingency. In section 2 we stated in stronger terms that evolutionary convergence could be viewed as a 'rerun of the tape of evolution', with final results that are broadly predictable. Hence, if life arises again elsewhere in the cosmos, we would expect some degree of convergence with the evolution of terrestrial human level of intelligence.

One scientific approach to test the hypothesis of a Second Genesis outside the Solar System is to search for extraterrestrial intelligence (the SETI project).¹³ One of the objectives of SETI is to test whether trends in evolution that have been observed on Earth may serve as a basis for understanding the eventual 'contact' between different forms of civilisations that do not belong to the same tree of life. Natural theology, on the other hand, is the body of knowledge about religion that can be obtained by human reason alone without appealing to revelation. Trends towards larger brains that have been observed in evolution on Earth, may serve for rationalising the concept of Divine Action in a con-

10 Fontana, W. & Buss, L.W. 'What would be conserved if "the tape were played twice"?' Proc. Natl. Acad. Sci. USA (1994) 91, 757-761.

11 Chela-Flores, J. *The New Science of Astrobiology From Genesis of the Living Cell to Evolution of Intelligent Behaviour in the Universe*, Dordrecht: Kluwer Academic Publishers (2001; 2004 pb.), <http://www.wkap.nl/prod/b/0-7923-7125-9> Chela-Flores, J. 'Astrobiology's Last Frontiers: The distribution and destiny of Life in the Universe', In Seckbach, Joseph J. (ed.) *Origins: Genesis, Evolution and the Biodiversity of Life*, Dordrecht: Kluwer Academic Publishers, The Netherlands (2004). <http://www.ictp.trieste.it/~chelaf/ss12.html>

12 Conway Morris, S. *The Crucible of Creation The Burgess Shale and the Rise of Animals*, London: Oxford University Press (1998), p. 202; Conway Morris, S. *Life's Solution Inevitable Humans in a Lonely Universe*, London: Cambridge University Press (2003).

13 Drake, F. & Sobel, D. *Is there anyone out there? The scientific search for Extraterrestrial Intelligence*, New York: D. Delacorte Press (1992); Ekers, R.D., Kent Cullers, D., Billingham, J. & Schefter, L.K., (eds.) (2002) SETI 2020, SETI Press: Mountain View CA

structive dialogue with science. The realisation that randomness in evolution does not rule out the existence of evolutionary convergence encourages an integrated approach for science and religion. Such an approach will clearly avoid a confrontation between faith and reason.

Alternatively, in searching for a Second Genesis inside the Solar System, the assumed universality of biochemistry suggests that biomarkers should be selected from standard biochemistry. We should decide whether the evolution of intelligent behaviour has followed convergent evolutionary pathways. In this context, we can begin testing the lowest stages of the evolutionary pathway within the solar system. We are in a position to search directly evolutionary biomarkers in the Jovian moon Europa. We have considered a set of evolutionary biomarkers if extant microorganisms are to be encountered on Europa.¹⁴

Why do we focus our attention on this satellite of Jupiter? There are several reasons, but the main one is related to the results retrieved from the most important mission of solar system exploration that took place last century: the Galileo mission arrived in the Jovian system in 1995 and completed its work in the month of September, 2003. This mission has exposed an environment that can, in principle, support life.¹⁵ However, the most interesting case concerns the next orbital mission the Jupiter Icy Moons Orbiter (JIMO), which is being planned for next decade. It is expected to determine specific locations where the icy surface is thin enough for a submersible penetration or, if the icy crust proves to be too thick, for testing directly on the surface for the presence of micro-organisms. We may conclude that within the realm of scientific research in the foreseeable future we can address the question of 'fine-tuning' in the following sense. Evolution of the cosmos, and especially biological evolution right from the biochemical level, may be 'fine-tuned' for the inevitable emergence of intelligent behaviour in the cosmos, provided there is preservation of steady planetary conditions over geologic time.

4. A Second Genesis: implications for science, theology and philosophy

One of the main ingredients of the study of other lives in the universe is convergence of the evolutionary process in biology. The evolution of life in the universe, either microscopic, or even life at a human level of intelligence, presents no insurmountable difficulties to natural theology. Witness to this fact is the statement made by Pope John Paul II in the presence of the Pontifical Academy less than a decade ago.¹⁶ Indeed, science and religion are both concerned

14 Chela-Flores, J. 'Testing Evolutionary Convergence on Europa', *International Journal of Astrobiology* (2003) 2 (4): 307-312, Cambridge University Press, <http://www.ictp.trieste.it/~chelafss13.html>

15 Johnson, T. 'Europa: overview of the future missions', In Seckbach, J., et al. (eds.) *op. cit.* (9)

16 John Paul II, 'Papal Message to the Pontifical Academy', *Commentarii*, Vatican City (1997) 4, N. 3, 15-20.

with the common understanding of the destiny of life in the universe. Since these two intrinsically different cultural activities largely address the same questions, they should, at some point, establish a dialogue, since the search for truth from different points of view should inevitably lead to a common objective.

What may present more of a conflict between science and religion is not the confrontation of science with a Second Genesis. Instead, a real difficulty would be the evolution of all the attributes of man, including those that are of prime importance for theology – the spirit of man. The question has been formulated a little more precisely:¹⁷ Is a creationist theory required to explain the origins of the spiritual dimension of the human being?

While we are still not in a position to answer this question, in this paper we have attempted to explain that contact with extraterrestrial life cannot be excluded in the foreseeable future. Knowledge, or merely awareness, of a Second Genesis would provide us with a solid point of reference on which to base original discussions on the implications of all the attributes of beings that have evolved to a human level of intelligent behaviour. In such discussions the participants should be scientists and natural theologians.

Yet we wish to remain within the constraints that the seminal contribution of Galileo Galilei has imposed on us. Science must remain as an experimental academic activity. Hence, the question of man's spirit and soul should, in principle, not even enter the biological discourse. However, man's spirit and soul are concepts that are relevant to moral philosophy (ethics). It may be argued that ethics and other branches of human knowledge should be integrated. The integration of biology and ethics seems particularly relevant to the dialogue of science and religion.¹⁸

Efforts towards such integration will undoubtedly help a coherent discussion of the evolution of the attributes of man. Such inquiries should include specific attributes of man that are most relevant from the point of view of theology. The subject of the philosophical and theological implications of a Second Genesis is an open problem.¹⁹ The large number of papers, books and encyclopaedia articles on the subject demonstrates this assertion. The authors of

17 Coyne S. J.G. 'The concept of matter and materialism in the origin and evolution of life', In Chela-Flores, J. & Raulin, F. (eds.) *Chemical Evolution: Exobiology. Matter, Energy, and Information in the Origin and Evolution of Life in the Universe*, Dordrecht.; Kluwer Academic Publishers, (1998), pp. 71-80.

18 Dewey, J. *The Influence of Darwinism on Philosophy*, New York: Peter Smith (1951); Maritain, J. *La philosophie morale. I. Examen historique et critique des grands systèmes*, Paris: Gallimard, Bibliothèque de Idées (1960). (Translation: Moral Philosophy, Evans, J. W. (ed.), London: G. Bles (1960). Available at: <http://www.nd.edu/Departments/Maritain/etext/jmoral.htm>

19 Russell, R. 'Life in the Universe: Philosophical and Theological Issues', *CTNS Bulletin* The Center for Theology and the Natural Sciences 21.2 (Spring 2001). [This paper was presented at the Sixth Conference on Chemical Evolution and first appeared in Chela-Flores, et al. (eds.) *op. cit.* (4) pp. 365-374.

these papers have been philosophers, scientists and theologians.²⁰ Such prolific output demonstrates this assertion. It is remarkable that a substantial number of theological discussions appeared in the middle of the twentieth century, although the subject itself of the possible role played by the Creator in the distribution of life in the universe began at least over two millennia ago. In fact, more than 2,300 years ago humanists speculated about the possibility that the maker of the universe 'distributed souls equal in number to the stars, and assigned each soul to a star'.²¹

Several theologians preceded the current wave of enthusiasm on the topic of the nature of extraterrestrial beings that may have reached a human level of intelligence. The authors of these papers that were published since the 1960s include T.J. Zubek, John P. Kleinz, James Harford, Daniel C. Raible, George Dugan, A. Carr, John J. Lynch, L. C. McHugh, Angelo Perego, Joseph A. Breig and J. Edgar Bruns.²²

A question that has been repeatedly raised in the past is the following: Should Christians expect that a single Incarnation of Christ in Jesus is sufficient for the redemption of all life in the universe? This has been discussed previously in this journal: Davis,²³ suggested that it may be unnecessary to postulate additional Incarnations. Man's reconciliation with God through the sacrificial death of Christ is assumed for understanding the redemption of any beings that may have evolved to a human level of intelligence elsewhere in the universe. Other authors agree with such a single, universal Incarnation, for instance, Ted Peters²⁴ and the distinguished English cosmologist and philoso-

20 Davis, J.J. 'The Search for Extraterrestrial Intelligence and the Christian Doctrine of Redemption', *Science and Christian Belief* (1997) 9, 21-34; Crowe, M. J. 'A History of the Extraterrestrial Life Debate', *Zygon* (1997) 32 (2), 147-162; Spradley, J. L. 'Religion and the Search for Extraterrestrial Intelligence', *Perspectives on Science and Christian Faith* (1998) 50 194-203; Wiker, B.D. 'Alien Ideas Christianity and the Search for Extraterrestrial Life', *Crisis Magazine*, November 4, 2002 (<http://www.crisismagazine.com/november2002/feature7.html>); Tanzella-Nitti, G. 'Extraterrestrial Life', In Tanzella-Nitti, G. & Strumia, A. (eds.) *Interdisciplinary Encyclopaedia of Religion and Science*, <http://www.disf.org/en/default.asp> and <http://www.disf.org/en/Voci/65.asp> ; Francisco, O.P. R. 'Possibilita' di una redenzione cosmica: implicazioni teologiche circa una suposta vita extraterrestre', In Bertola, F. Calvani, M. & Curi, U. (eds.) *Proc. Venice Conference on Cosmology and Philosophy*, Ca' Dolfin, Venice, December, (1992) Origini: l'universo, la vita, l'intelligenza. Padova: Il Poligrafo (1994), pp. 95-112.

21 Plato (360 BC) *Timaeus*, Classics in the History of Psychology, An Internet resource developed by C. D. Green York University, Toronto, Ontario, translated by B. Jowett, <http://psychclassics.yorku.ca/Plato/Timaeus/timaeus3.htm>.

22 For more detailed bibliographic information, see Vakoch, D.A. 'Roman Catholic Views of Extraterrestrial Intelligence: Anticipating the future by Examining the Past', In Tough, A. (ed) *When SETI Succeeds: The Impact of High-Information Contact*, Bellevue (Washington): Foundation for the Future (2000), pp. 165-174; for references to the work of previous centuries see the review of the astronomer and historian of science Francesco Bertola: Bertola, F. 'The Plurality of Worlds', In Chela-Flores, et al. (eds.) *op. cit.*, pp. 401-407.

23 Davis, J.J. *op. cit.* (20).

24 Peters, T. 'Exo-theology: Speculations on Extra-Terrestrial Life', *CTNS Bulletin*, The Center for Theology and the Natural Sciences 14.3 (Summer, 1994).

pher Edward Arthur Milne (1896-1950).²⁵

Some of the barriers to the dialogue between science and religion can be traced back to the fundamental question of how to read the Holy Books of the three monotheistic religions. In the fifth century, Augustine had touched on this question in his book in *The City of God*.²⁶ In fact, Augustine discussed a clear separation of two alternative ways of interpreting the Bible, firstly, as a source of spiritual reflection and ethical values, and secondly, as a substitute for scientific matters. In agreement with most thinkers today, Augustine encouraged us to accept the first interpretation. According to Augustine, scientific matters should not be inferred from a literal reading of the Holy Book. In cases of conflict, Augustine advocated in favour of an allegorical interpretation of the Bible, rather than as a substitute for science.

Conversely, if science were to provide irrefutable evidence of the emergence of life elsewhere (cf., Section 3), theologians could read the texts of the New Testament in a broader context:²⁷ 'And I have other sheep that are not of this fold; I must bring them also, and they will heed my voice. So there shall be one flock, one shepherd' (John 10:16).

On the other hand, an alternative view in natural theology, envisages multiple Incarnations. This approach has also received much attention. Christian theologians in this group are Paul Tillich,²⁸ Eric Mascall²⁹ and Ernan McMullin.³⁰

Finally, Pierre Teilhard de Chardin (1881-1955), the French philosopher and palaeontologist, developed an interdisciplinary approach³¹ to the question of redemption that has implications for the evolution of life in the universe. It has been criticised by Medawar.³² However Teilhard's work should be seen not as an alternative to scientific thought, but as a personal effort to achieve a synthesis of his mainly theological thinking. Teilhard turned away from the exclusively scientific, or even the exclusively philosophical, when he accepted to convert his work into a contribution to natural theology. (In the past some of the critics of *The Phenomenon of Man* have ignored the restricted scope of Teil-

25 Milne, E.A. *Modern Cosmology and the Christian Idea of God*, (Edward Cadbury Lectures, 1950), Clarendon Press: Oxford, (1952), p. 153.

26 Augustine, *St City of God*, London: Penguin Classics (1984), Book XVII, Chapter 3.

27 Francisco, O.P. R. *op. cit.* (20)

28 Tillich, P. *Systematic Theology*, Vol II Chicago: University of Chicago Press (1957), p. 96.

29 Mascall, E. L. *Christian Theology and Natural Science*, New York: Ronald Press (1956), pp. 37-39.

30 McMullin, E. 'Life and Intelligence Far From Earth: Formulating Theological Issues', In Dick, S. (ed.) *Many Worlds: The New Universe, Extraterrestrial Life and the Theological Implications*, Philadelphia: Templeton Foundation Press (2000).

31 Teilhard de Chardin, P. *The Phenomenon of Man*, London: Fontana Books (1965).

32 Medawar, P. *The Limits of Science*, London: Oxford University Press (1984).

hard's natural theology.³³) Indeed, he suggested that when humanity and the world have reached their final state of evolution, a new convergence between them and God would be initiated by a future return of Christ to judge both the living and the dead (a 'Second Coming' of Christ). Teilhard asserted that the work of Jesus of Nazareth was primarily to lead the material world to a truly cosmic redemption.

5 Discussion

Naturalism in philosophy is a concept used by G.E. Moore as an approach that intends to relate the scientific method to philosophy by affirming that all beings and events in the universe are natural. Consequently, all knowledge of the universe, including ethics, falls within the range of scientific investigation. The American philosopher John Dewey³⁴ was a strong supporter of this doctrine.

On the other hand, Jacques Maritain emphasised the notion of a 'cosmic morality' that is independent of Darwinian evolution. His review and criticism of the views on naturalism of John Dewey is relevant if it is inserted in the context of the possible existence of life in the universe. Sadly, Maritain passed away in 1973. Since that time much progress has taken place in natural theology to sort out evolutionary biology's challenge to theology; in other words, the puzzle of God's relation to an evolutionary process that is characterised by the long history of variation, mutation and selection.³⁵

Some clarification of these issues has been formulated by the contemporary American theologian John Haught, who has discussed the compatibility of Darwinism and natural theology in the context of kenotic process theology:³⁶ Process theology rejects Divine Action in terms of causality, proposing that God acts persuasively in all events, but not necessarily determining their character; kenosis means self-emptying and voluntary sacrifice on behalf of others.³⁷

A philosophy like John Dewey's draws our attention to the possibility that ethics may be regulated exclusively by the 'positive sciences', namely the sciences that range from physics to biology and sociology. In Dewey's integrated

33 Chela-Flores, J. 'The Phenomenon of the Eukaryotic Cell', In Russell, R.J., William R. Stoeger, S.J. & Francisco J. Ayala, (eds.) *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*, Vatican City State/Berkeley, California: Vatican Observatory and CTNS (1998), pp. 79-99. <http://www.ictp.trieste.it/~chelaf/ss20.html>

34 Dewey, J. *op. cit.* (18)

35 Tracy, T. F. 'Evolution, Divine Action, and the problem of Evil', In Russell, R.J., et al. (eds.) *op. cit.*, (33), pp. 511-530.

36 Haught, J.F. 'Darwin's gift to theology', In Russell, R.J., et al., (eds.) *op. cit.*, (33) (1998), pp. 393-418.

37 Ellis, G.F.R. 'The thinking underlying the new 'scientific' world-views', In Russell, R.J., et al. (eds.) *op. cit.*, (1998), p. 276.

view of science and philosophy, it is assumed that the above-mentioned scientific disciplines should be comprehensive enough to allow intelligent beings to make ethical choices according to scientific procedures.

Maritain distinguishes the concepts of spirit (a theological concept) and nature (a scientific subject). In spite of this Maritain argues that there is room for the supernatural, as Christianity understands this word, for instance, in the interpretation of the Gospels, or more generally in the interpretation of the Holy Books.³⁸ A criticism that has been directed to the views of Maritain, is that his arguments are based on a form of foundationalism. In epistemology foundationalism means that knowledge could be started from basic beliefs (which in turn may support other beliefs, thus providing a 'foundation' upon which all new knowledge could be inferred). Such basic beliefs are assumed to be self-evident; they need not be justified by more basic beliefs. (There are two different ways beliefs are justified:³⁹ some beliefs are justified by being based on evidence, while others are justified even though they are not based on evidence – even though they are basic. This twofold division of justified beliefs forms the basis for foundationalism.) Clearly, in Maritain's work and, more generally in Christian theology, some form of foundationalism may be expected to be inevitable.

However, it is important to recall arguments in favour of the viability of Christian belief on non-foundational premises due to the work of the American contemporary theologian Alvin Plantinga. The focus of the defence of his philosophical system, known as Reformed epistemology,⁴⁰ is to concentrate on the question: Does basic theistic belief count as knowledge if it is true?⁴¹ Here 'theistic belief' means any belief that directly entails the existence of the God of monotheistic religions. The backbone of a philosophical system that attempts to equate theistic belief with knowledge is the understanding of a postulated property that converts a true belief into knowledge. This property has been labelled as 'warrant', thus the philosophical system of Reform epistemology is strongly steeped in the development of what warrant really is in the specific case of this philosophical doctrine. The English language usage of this word is 'something serving as a ground for a belief', for instance, as used in the phrase 'this development gives warrant in saying that it is new'. Thus Warranted Christian Belief is a philosophical approach attempting to replace foundationalism. Briefly, 'evidentialism' is the doctrine that claims that theistic belief must be based on *evidence* in order to be justified. Plantinga argues that when we define evidentialism as the view that theistic belief is justified only if it is

38 Maritain, J. *op. cit.* (18)

39 Sennett, J. F., In *God Matters*, Martin, R. & Barnard, C (eds.), New York: Longman, (2003); pp. 219-31.

40 Plantinga, A., *Warrant: The Current Debate*, New York: Oxford (1993); *Warrant and Proper Function*, New York: Oxford (1993); *Warranted Christian Belief*, New York: Oxford (2000).

41 Sennett, J.F., *op. cit.*, (39)

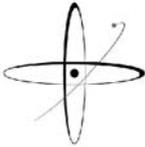
based on other beliefs, it turns out that evidentialism is indeed the denial of Reformed epistemology. Plantinga discusses the relationship between evidentialism and foundationalism and argues against them. This approach opens another possible discussion of other intelligent beings on different lines from Maritain.

Although some of the views of Maritain can be criticised, especially from the point of view of the Reformed epistemology, the attributes that universal biological evolution may grant to other intelligent beings are still relevant today for the scientific search of extraterrestrial intelligence (SETI). How far can we trust that evolution will give convergent results on attributes that we already know to have evolved in human beings?

We do not wish to address in this brief paper whether the position highlighted by Dewey is tenable, or whether the opposing view of Maritain is valid. The above arguments, and some of their criticisms, are presented merely as illustrations of the relevance of a Second Genesis to human culture, not only to the new science of astrobiology, but also to both moral philosophy, as well as natural theology.

To sum up, up to the present time the intelligibility of the universe has been a topic restricted to natural theology. The arguments presented in this paper argue in favour of bringing this fundamental topic within the frontier of science. Consequently, future exploration of the solar system, and beyond, in the search for other lines of biological evolution should be considered a priority in science, as well as in ethics, philosophy and natural theology.

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