Communications

Creative Providence in Biology

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Theists agree that, ultimately, God is the Creator of everything. And they agree that he graciously and continuously provides for the needs of all his creatures. There is much uncertainty and disagreement, however, about the how of his creating and providing. Some think he intervenes occasionally or often, others believe he initially created a gapless economy of parameters and natural laws which take care of everything. I propose that both theological and scientific indications point to a continuous, active, but usually hidden involvement of the Creator in all that happens.

Roughly speaking, the Bible tells us about the Creator, and science tells us about his creation. A theist needs to integrate the two aspects. The book, *God Did It, But How?* by Robert Fischer deals with creation,[1] but the idea applies to providence, as well. Biblical theology clearly presents God as both Creator and Provider. *How* might he have created and *how* might his providence work? Has he ceased creating after an initial creation? And *how* is his continuing providential work to be understood?

Creation's "Functional Integrity"

Howard Van Till has presented his concept of "creation's functional integrity."[2] He insists that God created a universe which from the outset had functional integrity, in the sense of being capable of producing everything God wanted it to produce at the appropriate time, without requiring any further "intervention." Van Till is not a deist believing this left God with "nothing to do" afterwards. In biblical theology, God is not only the Creator of the universe, but he also continually upholds all of his creation,[3] actively keeping it in existence. Of course, God is capable of performing any "supernatural" acts he chooses to do ("miracles"). But he is just as much the Author of any of the "natural" processes science is able to investigate. Therefore, it is not meaningful to talk about God "intervening" in the created order, as if his hand was not already in it anyway. But his creation is evolving "naturally," and it is he who made it do so. Whatever evolutionary processes occur in the history of the universe or of life are acts of God. Van Till's view of creation's functional integrity for the development of the universe may be essentially correct—in the physical realm.

The emergence of biological information, however, cannot be dealt with in the same way. Biological systems, starting at the molecular level, are extremely complex, requiring a large amount of information for their full specification. When and how did this information originate?[4] Did it spontaneously arise each time some new biological structure or function evolved, or did it emerge all at once at the origin of life, or was it created at the origin of the universe? On the basis of what is known, all of these options are unconvincing. A spontaneous emergence of all biological information out of the environment appears implausible,[5] and its having been stored ahead of time in a prebiotic universe even more so.

Van Till includes the biosphere in his concept of functional integrity. Apparently, he does not deem the origin and evolution of nonliving and living systems (even human life) to require different treat-

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ments. Does this imply that all biological structures, functions, and species developed spontaneously and inexorably by physicochemical necessity and chance? Van Till does not call the emergence of biological systems autonomous, but considers all of it to be decreed by God from the beginning. However, with his concept of functional integrity, it would have been autonomous in the sense of not requiring anything God had not yet "gifted creation with from the outset." God certainly could have done it this way if he had chosen to do so. But as with the statement that he could have created every species *de novo*, the question is not what God *could* do, but what he did.

Van Till's view necessarily implies that most of the information required for the structures and functions in the biosphere, including humanity, was either contained in the energy, strings, plasma, or whatever of the early big bang—and in the prebiotic universe ever since, or that it emerged by self-organization out of nothing—which is what is usually claimed. From what is known in the biological sciences, it appears preposterous to believe in either possibility. Curiously, Van Till seems to prefer the first version, explicitly including "biological systems" among the "basic entities" which God "from the beginning, when the creation was brought into being from nothing," gifted with all of the capacities needed.[6] Yet biological systems did not come into existence for over ten billion years. What and where were these systems with their capacities before the origin of life? If their blueprints were not stored in the physical universe, but in the mind of God, then what is the difference from saying he introduced this information at the appropriate time—first into the prebiotic Earth's crust, ocean, or atmosphere and later into the biosphere? As for the other version, to date, the talk of "emergence of information by self-organization" is not supported by any relevant theoretical, observational, or computational evidence and is therefore rather vacuous.

God's Hidden Options

What could be the source of information for the origin and further development of life? I do not suggest any divine "interventions" through "gaps" in the sense Van Till rejects. For theological reasons, I believe that God "hides his footsteps" in creation to protect the personal freedom he has chosen to give us so that we can make a faith decision for or against him.[7] His footsteps in creation are plain, but only to those who choose to believe; to others, their evidence is ambiguous. As for those who believe in self-organization of the biosphere, their faith in miracles in chemistry and molecular biology is amazing. Therefore, miraculous interventions are not to be expected on theological grounds, but autonomous events of transastronomical improbabilities are scientifically unbelievable. What alternative possibilities could be envisioned?

There are plenty of "gaps" of knowability which can never be bridged by science, not just for the present, but in principle. They are fundamental impossibilities for science. But God is free to act everywhere—where scientific investigation is possible, and where it is not. In order to clearly distinguish these limits from the gaps of "god-of-the-gaps" views, I prefer to call them God's "hidden options." To be more specific, they may include quantum uncertainties, randomness in elementary events, unpredictability due to minute parameter value deviations in nonlinear systems liable to produce deterministic chaos,[8] and coincidences. For instance, the spontaneous occurrence of a specific combination of mutations required for the emergence of a certain enyzme activity may, in context, be transastronomically improbable. Even so, we can never prove it impossible, as the tails of the Gaussian probability distribution extend to infinity. Yet God may have chosen to actively decree it to occur.

Such "hidden options" do not represent acts of "special creation" in the sense of exceptions to any natural law. Rather, they are specific acts of *selection* among distributions of many different naturally possible values for stochastic variables. The only thing that is "supernatural" about them is the fact that selecting specific events means feeding information into the system. The physical system does not display any lack of functional integrity, but it needs information, just as a fully functional computer requires software, data, and input events to do any useful work.

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Of course, the only reasonable interpretation of such a hidden source of biologically meaningful information is the Creator. Intelligent design in biology cannot be divorced from God.[9] How often such hidden acts of selection would occur is another question. It seems to be very difficult to answer. I believe the biblical Hebrew term *bara'* (to create) would correspond to God's introducing new information. Of course, it occurs in Gen. 1:1, where it refers to the initial creation of the universe, but it is also used in various other contexts. The Old Testament explicitly applies it to God's creating individuals—not only humans,[10] but even animals.[11]

No God-of-the-Gaps

The "hidden options" suggested are very different from "god-of-the-gaps" speculation:

1. There is no logical reason, either scientific or theological, for excluding such hidden options in principle.

2. They are claimed for scientific reasons, not theological ones.

3. We know from science that these fundamental limits for scientific investigation exist.

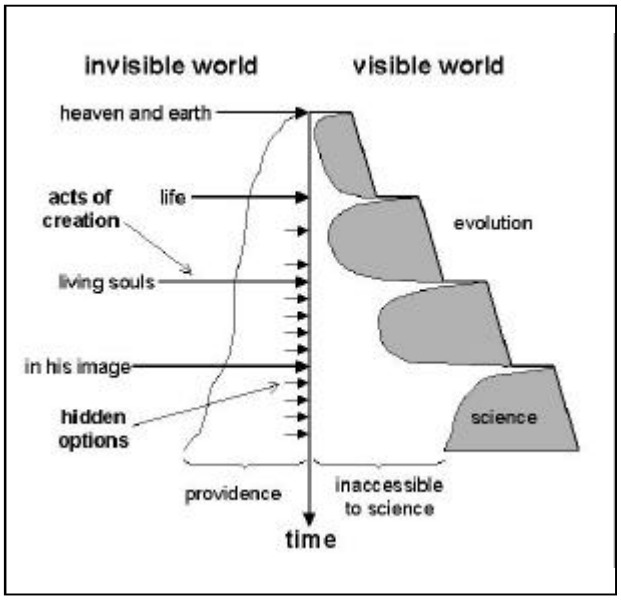
4. They are not research-stops, but just honest admissions of ignorance in place of obfuscating just-so stories.

5. They avoid the gratuitous appeal to future science, which is very vaguely and optimistically expected to be able, some day, to bridge gaps in our present knowledge.

6. They are not gaps in which a usually inactive god would exceptionally intervene.

7. They are not gaps in God's initial plan, but from the beginning a part of what he presumably intended to do at the appropriate time, in addition to his activity in the processes open to scientific enquiry.

8. They are not gaps in "creation's economy" as all materials and their properties were fully in place and well equipped to proceed anywhere in development, just sometimes in need of the specific direction required (being, for lack of time, unsuccessful in mere random-walk trials).



God's Actions and Scientific Investigation.

Simplest Biopolymers Are Transastronomical

The reason why random mutations, followed by natural selection, cannot produce all biological functions and an entire biosphere is the huge size of the possibility space; for biopolymers, such as DNA and proteins, this is sequence space. The tandem of random mutation and natural selection is too inefficient, especially in the starting phase of the evolution of a new function, when selection coefficients are small or even nonexistent. In the latter case, random walks are free and unselected, so that their probabilities can be estimated. Most protein domains are about one hundred amino acids long.[12] But even the sequence space of those as short as 62 amino acid residues comprises $20^{62} > 10^{80}$ different sequences. As the known universe contains about 10^{80} nucleons, the protein domain sequence space is therefore transastronomical, such that it cannot be productively searched by any random processes.

Proteins performing the same function in different biological species usually have similar sequences. It is reasonable to assume that those features of these sequences which are invariant in all species are required to perform the common function. The simplest version of this invariant set is the number of invariant amino acid placements. As in some other positions restricted groups of similar amino acids can replace each other without loss of function, appropriate fractions of one have to be added for each of them.[13] The size of known invariants is about 30% of the number of amino acids in the sequence, although the percentage varies. To be more precise, one should take into consideration any species-specific requirements, but these are usually unknown.

The invariant being smaller than the entire protein, the possibility space for a specific biological function is very much smaller, and the probability that any one of the acceptable sequences is accidentally produced is much larger than for a unique sequence. Yet, the possibility space of the invariants of proteins containing two small domains of one hundred amino acids each is again transastronomical. But the average protein size is perhaps twice as large. Therefore, in principle it is impossible to demonstrate that a belief in spontaneous evolution of today's biosphere is plausible—unless it can be shown that very much smaller "primitive" precursor systems are functional.

Even Mini-specifications Inaccessible

Proteins more "primitive" than the modern ones may have displayed much smaller invariants and correspondingly weaker and less specific functions. The minimum of any invariant can only be reached by means of a nonselected mutational random walk, since before that point, there is nothing to be selected, as far as the activity required is concerned. What is the size of such a minimal invariant? The only proteins we know are the highly specific modern ones. An attempt to design a miniaturized redox enzyme has not yet achieved its goal.[14] The undecapeptide dimer synthesized can hold an iron atom, but the complex lacks the stability required, being too small to shield off the environmental water. So far, its invariant may be at least about five; it will be larger once the protein is functional. But the largest invariant attainable by nonselected mutational random walks on Earth within three hundred million years was estimated to be between two and three only, even with wildly overly optimistic assumptions.[15]

In order to find out whether a belief in spontaneous evolution of the biosphere is plausible, the best we could hope for would probably be to design and synthesize a feasible initial substrate for Darwinian evolution, namely a functional, self-replicating mini-organism comprising a minimal set of miniproteins of minimal activity only, each of which requires an invariant of less than three, or an equivalent RNA organism. Those familiar with origin-of-life research know that, in the foreseeable future, this goal is unattainable.[16] As life arose at least 3.8 billion years ago, such a mini-organism, with a genome much smaller than that of the simplest known bacteria, would have had to be available shortly after the initial catastrophic bombardment of the Earth with planetesimals ceased.

Are God's Creatures Perfect?

Are there any *theological* reasons for excluding God's "hidden options?" Van Till seems to suggest that it would detract from God's honor to admit that he created something in an unfinished or imperfect state. In a similar vein, believers in a young Earth maintain that everything that God created must have been perfect immediately, originating in sudden fiat creations out of nothing, as anything else would deny the absoluteness of his wisdom and power. Of course, Van Till's concept of functional integrity of creation does permit long developmental processes, but exclusively by "natural" means. But what is the theological justification for claiming such integrity not only for the Creator himself, but for created systems and processes?

Van Till appeals to the early church fathers, Basil and Augustine, who apparently arrived at a similar concept of a functional integrity of creation.[17] It is understandable that they felt that way. In their day, natural philosophy presumably still had a strongly platonic inclination, believing in eternal, perfect, ideal forms. As they knew nothing of the large-scale development of the universe and of life's complexity, Plato's idealism might have looked reasonable to them, just as they had no qualms believing in a spontaneous generation of some kinds of organisms. Yet, can we be confident that their idea of God being creatively active only once did not primarily rely on platonic idealism, but rather on biblical data? What are the biblical data in context?

Comparing with God's Revealed Ways of Acting in History and Revelation

The Bible often talks of God's acting in human history, but much less of his acting in the history of the universe and of life. Nevertheless, we may perhaps compare the two areas to some degree. God guided the history of his people by continuously shaping many big and small events. If it were not for the biblical proclamations that these events and developments represented God's direct action, one might attribute many of them to "natural causes," like human tendencies, coincidences, etc. In this sense, we may say that God used "hidden options," i.e., he did specific things in human history of which we know by revelation only that it was he who did them. Secular history or other sciences may, at most, tell us some of the natural aspects of these events, but nothing of God's primary agency.

Would the concept of creation's functional integrity applied to such events tell us that, from the outset, God preprogrammed all of history, down to a suitable level of details, into the physical universe, excepting only the modifications to be expected from some free will decisions by his creatures? There is no biblical indication for this. The Bible just tells us that God did it. Of course, God knows everything that is going to happen in the future, but preknowledge does not automatically imply predestination. God deals personally and individually with people in history.

Why should he not care to guide individual mutations and their selection? Apparently, he arranges births and deaths of individual animals.[18] As far as their individual origins are concerned, we are told that God creates them (the strong word *bara'*), presumably using "hidden options" in genetic and reproductional processes.

There are parallels between creation, revelation, and salvation. Each is done by God's Word, and each uses limited "natural" processes guided by God. In Jesus Christ, God "emptied himself" and "became flesh" in human weakness—this is his method of salvation.[19] But Jesus remained in perfect communion with the Father and in subjection to him, so the Father could guide him continuously. God's method of revelation had a similar character: the biblical texts were received, written, kept, copied, selected for canonization by fallible humans, thus introducing some weaknesses. But God guided the process, preventing mistakes of a relevant order. This same reality may well apply to his method of creation, too, in the sense that he did not create a platonically ideal system which works all by itself. He may have initiated processes developing in time, while imperceptibly guiding the system wherever and whenever it needed guidance. ⁜

Notes

[1] R. B. Fischer, *God Did It, But How?* (Grand Rapids, MI: Zondervan, 1981).

[2] H. J. Van Till, "Special Creationism in Designer Clothing: A Response to 'The Creation Hypothesis,'" *Perspectives on Science and Christian Faith (PSCF)* 47 (1995): 123; H. J. Van Till, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," *Science & Christian Belief* 8 (1996): 21.

[3] Hebrews 1:3.

[4] The amount of information a biological system can glean from the environment, by means of the process of mutation and natural selection, is vastly insufficient, and this process operates much too slowly.

[5] The arguments for this view were dealt with in P. Rüst, "How has Life and its Diversity Been Produced?" *PSCF* 44 (1992): 80, and again touched upon in A. Held & P. Rüst, "Genesis Reconsidered," *PSCF* 51 (1999): 231. Similar views have been expressed by R. Forster & P. Marston, *Reason, Science & Faith* (London: Concorde House, 1999).

[6] H. J. Van Till, "Special Creationism in Designer Clothing: A Response to 'The Creation Hypothesis,'" *PSCF* 47 (1995): 123.

[7] P. Rüst, "How has Life and its Diversity Been Produced?" *PSCF* 44 (1992): 80.

[8] G. P. Williams, *Chaos Theory Tamed* (Washington, DC: Joseph Henry Press, 1997).

[9] The claim of intelligent design theorists that the design inference rests squarely within science is, for biology, unconvincing; their examples are restricted to cases like archeology, forensics, and putative extraterrestrial intelligence: none has a prehuman and non-ET, or even a prebiotic reference. Cf. W. A. Dembski, *The Design Inference* (Cambridge: Cambridge University Press, 1998); W. A. Dembski, ed., *Mere Creation* (Downers Grove, IL: InterVarsity Press, 1998).

[10] Psalm 102:18; Isaiah 43:7; Malachi 2:10.

[11] Psalm 104:30.

[12] A domain is a part of a protein sequence folding into a discernable partial structure, often devoted to a specific aspect of the protein's function.

[13] H. P. Yockey, *Information Theory and Molecular Biology* (Cambridge, UK: Cambridge University Press, 1992), 129, describes the precise information theoretical procedure to be used.

[14] A. Lombardi, et al., "Miniaturized Metalloproteins: Application to Iron-Sulfur Proteins," *Proceedings of the National Academy of Sciences USA* 97 (2000): 11922.

[15] P. Rüst, "The Unbelievable Belief that Almost any DNA Sequence Will Specify Life," unpublished paper (1988) presented at the Conference on Sources of Information Content in DNA in Tacoma, WA; P. Rüst, "How has Life and its Diversity Been Produced?" *PSCF* 44 (1992): 80. Evolutionary alternatives to random chains of point mutations (such as recombination and other macro-mutations) are much rarer than single-base mutations (cf. A. Rokas & P. W. H. Holland, "Rare Genomic Changes as a Tool for Phylogenetics," *Trends in Ecology and Evolution* 15 [2000]: 454) and hardly produce any new information, as they mostly shuffle pre-existing contents; also, the functional starting sequences would have to originate first.

[16] L. E. Orgel, "The Origin of Life—A Review of Facts and Speculation," *Trends in Biochemical Science* 23 (1998): 491; L. E. Orgel, "Self-organizing Biochemical Cycles," *Proceedings of the National Academy of Sciences USA* 97 (2000): 12503.

[17] H. J. Van Till, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," *Science & Christian Belief* 8 (1996): 21.

[18] Psalm 104:29–30; Matthew 10:29.

[19] Philippians 2:7; John 1:14.