though he or she will point out that God's activity is not restricted to those aspects of the world. But if God acts in the gaps through lawful natural processes then those gaps can in principle be filled by scientific investigation of those processes, so that GOG is superfluous. If, on the other hand, God acts in the gaps directly, without the mediation of natural processes, then GOG amounts to the erection of a STOP sign for scientific investigation when particularly puzzling phenomena are discovered. So much for explanatory power!

GOG, contrary to Snoke's belief, has no predictive power. The idea that God fills the gaps that science can't explain doesn't "predict" that there are any gaps, let alone the character of the gaps that may exist at any given stage of scientific development. The claim that "exquisite fine tuning" is an example of "successful prediction" is false. Who, before attention was drawn to the anthropic coincidences by Brandon Carter and others in the past thirty years, ever "predicted" from GOG that the electromagnetic and nuclear interactions had just the right strengths to enable heavy elements to be built up in stellar interiors?

God of the gaps arguments should be abandoned. They are of no value for serious theology or serious science.

Notes

¹E.g., George L. Murphy, "Chiasmic Cosmology and Creation's Functional Integrity," *Perspectives on Science and Christian Faith* 53, no. 1 (March 2001): 7.

²Dietrich Bonhoeffer, *Letters and Papers from Prison*, enlarged edition (New York: Macmillan, 1972), 311, 360–1.

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Does God Choose Among Hidden Options? A response to Peter Rüst

I wish to thank Peter Rüst for his thoughts on "Creative Providence in Biology" (*PSCF* 53, no. 3 [September 2001]: 179–83). The question on which he focused is one that continues to perplex many of us who seek to integrate our Christian belief system with our scientific understanding of the universe. To put the question in my own words, *In the context of what we have come to know via the natural sciences about the character of the universe and of its formational history, how can we best articulate our understanding of divine action – both creative and providential?*

I shall begin my response by saying that I believe that we *do* need to re-articulate our concept of divine action. I have a high respect for the theological tradition of my Calvinist heritage, but the theology that I was taught—like the theology taught to the vast majority of Christians today—was framed in the conceptual vocabulary and thought patterns of centuries long past. My own theological heritage clearly bears the marks of having been crafted within the framework of a late-medieval world picture geocentric in both its physical structure and its focus of attention, unaware of the multi-level (quarks to quasars) structure of the universe, unaware of its formational history and its astounding array of formational capabilities, and unable to imagine that we would someday have empirical access to that history and to the creaturely processes that have contributed to it.

This inherited world picture includes a conceptual vocabulary for speech about divine action. Most of us were presented with a picture of God as an all-powerful, transcendent, person-like being who was both able and willing to engage in supernatural intervention-particular acts in which the continuity of the creaturely cause/effect system was interrupted and superseded by coercive divine action. I say "coercive" not to imply any lack of loving motivation but to denote divine action that forces creatures to act in ways contrary to or beyond what they could otherwise have done. Traditional portraits of the creation's formational history often made liberal use of the supernatural intervention motif. Episodic creationism, for instance, envisions divine creative action in a way that places great emphasis on the idea that new structures and life forms were actualized, not by creatures using their God-given formational capabilities, but by the direct form-conferring action of the Creator. Relics of these traditional portraits remain in use today - museum pieces now grandly framed with gilded claims of empirical support.

As Rüst noted, I have long sought to portray both the creation and God's creative action with a vision that is founded on the historic Christian doctrine of creation but crafted in the conceptual vocabulary of *this* day. The conceptual vocabularies of centuries past can no longer be treated as if they remained adequate in this era. We should no longer be content simply to repeat things exactly as they were said in the sixteenth century, or in the first century. It is no longer adequate simply to *say* what they *said*—be they medieval theologians or biblical writers. Instead, we must, I believe, *do* what they *did*. We, like our predecessors, must experience God's presence in the world about us and craft our portraits of divine action in the conceptual vocabulary of our own time and place.

In that spirit I have tried to introduce a few new terms into our speech about the creation and about God's creative action. I have, for instance, suggested that the creation was gifted from the outset with *functional integrity*—a wholeness of being that eliminated the need for gap-bridging interventions to compensate for formational capabilities that the Creator may have initially withheld from it.¹ In the same spirit, I have suggested that the creation is aptly and accurately described by the *Robust Formational Economy Principle*—an affirmation that the creation was fully equipped by God with all of the resources, potentialities, and formational capabilities that would be needed for the creaturely system to actualize every type of physical structure and every form of living organism that has appeared in the course of time.²

I have freely admitted that I cannot *prove* these statements in the narrow logical sense, but I find these concepts to be both theologically attractive and scientifically warranted. They are theologically attractive to me in part because they provide the occasion to celebrate both God's *creativity* (in conceptualizing a formational economy sufficiently robust to make evolutionary development possible) and God's *generosity* (in giving such wholeness/ integrity of being to the creation). In the arena of science, this vision of a universe having a robust formational

Letters

economy has accumulated a track record of being a remarkably fruitful foundation for essentially all scientific theorizing about the formational history of the universe and of a diverse array of structures/forms within it.

However, as already hinted, this concept of a creation fully-gifted from the beginning with a robust set of formational capabilities does have a noteworthy implication regarding the character of divine creative action-no form-conferring interventions need be performed. With no "capability gaps" to bridge, no coercive divine action is required to actualize any type of physical structure or life form. The creation itself would have been given the requisite resources to accomplish the Creator's intentions for its formational history. In this vision, the signature of the Creator is seen, not in what the creation cannot do (and must be compensated for), but in what the creation can do (with its generously provided capabilities).³ The divine action of creating is not concentrated in a few occasions of form-conferring intervention, but in the giving of beingequally essential at every moment of time.

But is God's action of giving the universe its being at all times sufficient for the creation's evolutionary development? Is there no need for God to perform additional particular acts (whether we call them creative or providential does not concern me at the moment) to assemble at least some of the creatures that have appeared in time? On this question the Christian community is divided. Episodic creationists hold fast to the judgment that the creation's formational economy is *not* sufficiently robust to accomplish the feats of self-assembly that the sciences incorporate into their theorizing. Episodes of form-conferring intervention are deemed by modern creationists to be essential for the formation of all manner of things, from terrestrial planets to bacterial flagella.

However, if the creation is gifted with functional integrity, as I have suggested, then form-conferring divine interventions are not necessary. Some critics have feared that I have thereby excluded all divine action from the universe, that I have effectively become a deist. But such an exclusion has never been my intention, and I have no plans to move in that direction. Suggesting that *one* form of divine action is unnecessary does not at all imply that *all* forms of divine action must be rejected. The question remains, however: How might we now speak of divine creative action in a universe characterized by functional integrity?

One possibility that I have suggested is to speak of God's non-coercive action in the biblical language of divine *blessing*—God acting in such a way as to encourage or ensure that the outcome of creaturely action will be generally fruitful.⁴ Genesis 1:22 and 1:28, for instance, could be taken to suggest that the fruitfulness of animal and human life may be seen as evidence of God's blessing.⁵ This is not the sort of action that lends itself to inclusion in a scientific model for animal or human reproduction.⁶ God's blessing is not just another causal factor to be included alongside of creaturely causal factors. No, I envision God's blessing as the enabling and constructive presence of God that manifests itself continuously in all of the remarkable things that creatures accomplish.

Process theology has invested a great deal of effort in developing a language for speaking of divine action that is

effective but non-coercive.⁷ Its vision of *naturalistic theism* rejects all forms of supernatural intervention that interrupts or overpowers the system of creaturely causes and effects. At the same time, it postulates that divine action is an essential aspect of every process and event that occurs. Divine action is not confined to occasional episodes of irruptive intervention; divine activity permeates the world of our daily experience. Yet this ubiquitous divine activity is never coercive; it does not force any creature to do anything. Like the human action of *persuasion*, divine action (within limits that follow from the character of God and of the God/world relationship) can be effective in stimulating the desired outcome without forcibly violating the object of its influence.

Naturalistic theism would, I believe, accept my characterization of the universe as having functional integrity and as being endowed with a robust formational economy. And it would agree, I believe, that the system of natural causes and effects are sufficient to account fully for all that has occurred in the universe's formational history. But it also makes what I consider to be a noteworthy contribution - a vastly enriched concept of what is "natural." The whole array of *natural* processes are considered by naturalistic theism to be permeated with divine influence – not overpowering intervention, but ubiquitous and persuasive action that within limits, is, effective. Whereas traditional supernaturalism emphasized the radical distinction between the Creator and the creation (a distinction that opens up the possibility of God coercively intervening in it), process theology is more comfortable with the kind of intimate relationship of Creator and the creation that is envisioned by panentheism – the world is in God, but God is more than the world.

In the context of these considerations, what does Rüst propose? If I have correctly understood, he is saying that even if the creation is gifted with functional integrity, one needs to postulate additional divine action (Rüst calls it "creative providence") to account for the formational history of the universe, at least for the formation of living organisms. He says: "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 manner" (p. 179).

What's the problem? On the basis of a number of considerations Rüst concludes that biological information could *not* have emerged "spontaneously" or "autonomously," that is, by creaturely action alone. In essence, Rüst judges that the possibility space of creaturely forms is far too large for the creation to have discovered and actualized the genetic portion of it in the time available and with the exploratory capabilities with which it was endowed. The emergence and evolution of life, in Rüst's judgment, could have come about only as a consequence of supplementary divine action.

What kind of suplementary action? In agreement with both process theology and my own proposition regarding the creation's robust formational economy, Rüst opts against the idea of coercive interventions. He says: "... [M]iraculous interventions are not to be expected on theological grounds, but autonomous events of transastronomical improbabilities are scientifically unbelievable" (p. 180). So, no form-conferring interventions are expected, says Rüst, but yet God must do *something* or the wealth of potential life forms will drown in the sea of "transastronomical improbabilities." Where I have suggested the language of divine *blessing*, and where process theologians have developed a metaphysical system in which to articulate a rich concept of God's *persuasive* action, Rüst introduces the idea of *hidden options* from which God might purposefully choose in order to effect a desired outcome.

Given the character of the universe, it seems that there are many instances of processes for which several outcomes are possible, but for which the particular outcome is not predictable. Following some process or event, the final state of the system is, we say, "underdetermined" by all that can be known about the initial state. This lack of knowledge is not temporary, a problem that might be overcome with further study, but is inherent in the nature of the universe. But the outcome of one of these "events" might be crucial to the formation of the first life form or to the pathway of evolutionary development. How is it that the outcome of the creation's evolutionary development is as remarkably fruitful as it appears to be? Is it evidence of divine blessing, as I have suggested? Is it the outcome of divine persuasion, as process theology proposes?

Rüst's suggestion is that God *chooses* particular outcomes from among the various options that are open. This action of choosing from available options, says Rüst, introduces new *information* into the situation and might account for the development of information-rich biotic systems that have been actualized against the highly discouraging odds of infinitesimal probabilities.

Rüst is not the only person to argue that the creation's formational processes must be supplemented by divine action of some sort. In fact, it is a remarkably common theme in Christianity today. Young-earth episodic creationism, for instance, cites a lack of sufficient time and purported degenerative effects of the Second Law of Thermodynamics in support of its arguments against the feasibility of evolution. And the standard claim of the Intelligent Design movement is that they can argue from empirical evidence to the conclusion that particular biotic systems could not possibly have come to be formed by natural means alone. Therefore, say some ID advocates, these systems must have been assembled, at least for the first time, by the form-conferring action of some nonnatural agent (usually presumed to be God).

I must confess that I find these claims (including those supplied by Rüst) about the purported shortcomings of the creation's formational economy less than convincing. For example, attempts to estimate the probability of actualizing some particular molecule or some more complex biotic structure can be made only if one knows, in considerable detail, *all* possible formational pathways to that outcome and *all* environmental factors that might affect the success of those formational processes. I find it highly unlikely that we know enough to make the numerical calculation of these probabilities with sufficient accuracy to have any meaning whatsoever. Ironically, of course, I cannot provide a numerical estimate of this likelihood, but the history of science does provide a useful illustration of what I have in mind.

Astronomers long considered the stark and harsh environment of space to be so inhospitable to the formation of molecules that there was little or no effort expended to search for them. A few relatively simple molecules like hydrogen (H₂), carbon monoxide (CO) and water (H₂O) were known to exist in gaseous interstellar clouds, but surely there was no chance for larger and more complex molecules to form in these cold, low density clouds. Right? Organic molecules assembled in frigid, dark interstellar nebulae? No way! And complex biomolecules like the amino acids needed for living organisms? Not a chance!

Wrong, wrong, and wrong again! Astronomers had vastly underestimated the formational capabilities of atoms and molecules and had failed to consider an important category of formational processes. In the last three decades, astronomers have discovered approximately onr thousand large molecular cloud complexes within the Milky Way Galaxy. These molecular clouds contain numerous species of molecules, some of them astoundingly complex, far more complex than had been expected. The actual formational economy of atoms and molecules is far more robust than astronomers and chemists had first imagined. Molecular clouds, cold and rarified by earthly standards, evidently provide all the resources and environmental conditions needed to make possible the formation of more than one hundred known molecules. Among these are several organic molecules relevant to life, including formic acid (HCOOH), acetic acid (CH₃COOH), ethyl alcohol (CH₂CH₂OH), and glycolaldehyde (HOCH₂COH), an 8-atom sugar molecule. Furthermore, given the observation of a number of closely related biomolecules, there is warranted optimism for the eventual observation of the amino acid glycine (NH₂CH₂COOH), one of the building blocks of protein molecules essential to life on earth.8

Against the background of such episodes in the history of science, I am inclined toward the judgment that our failure to understand how certain molecular or biotic structures could have been assembled for the first time is an indication, not of missing capabilities or low probabilities, but of the limited power of human imagination. I could be wrong, but "that's the horse I'm betting on."

For a couple of reasons, I also find myself uneasy about Rüst's proposition that God routinely acts to overcome improbability barriers by choosing the particular outcomes of processes or events. First, why would these key probability values be so low to begin with? For anyone who, like Rüst, sees the universe as a creation that was given being by God from nothing, there seems to be only one answer: God must have designed the formational economy of the creation to include these low probability values so that acts of divine choice among hidden options would have to be performed at a later time. Thus, the need for Rüst's proposition of divine choices among hidden options arises in essentially the same manner as the purported need for acts of *divine intervention*, whether of the young-earth creationist or the intelligent design variety – God designed the creation's formational economy in such a way as to necessitate some form of compensatory action at a later time. For theological considerations, I am uncomfortable with this "withhold now, compensate later" concept of divine creative action.

My second concern, also theological in character, has to do with the way in which Rüst's "hidden options" proposal functions as a form of *occasionalism*, a perspective (attributed to Nicolas Malebranche) that denies true cause-

Letters

effect relationships in the creaturely world. Creaturely action is not real because one creaturely state is merely the occasion for God's directly bringing about the next creaturely state. Divine action is the real cause of things; creaturely cause-effect relationships are no more than appearances. Rüst may be correct in saying that the exercise of divine choice that he proposes does not constitute a special creation or a supernatural intervention in the strong sense of coercing a creaturely system to do something contrary to or beyond its creaturely capabilities. Rüst's proposal does offer, it seems, a picture of divine action somewhat different from the usual episodic creationist concept of divine intervention. Nonetheless, I remain uncomfortable with the occasionalist flavor of his picture in which particular outcomes are entirely determined by divine choice. As viewed from the outside, events in which God exercised such a choice would look like purely creaturely events because there would be no violation of any normal creaturely behavior pattern. Yet the particular outcome would have been effectively determined by divine selection. Authentic creaturely action has, by the controlling action of divine choice, been replaced by appar*ent* creaturely action. In the limit, God becomes a divine Puppeteer.

Finally, does Rüst's proposal successfully avoid the pitfalls of the familiar god-of-the-gaps strategy? In part, but not wholly. Rüst does not introduce divine action as the means to bridge a capability gap in the creation's formational economy in the same way in which episodic creationism ordinarily does. Nonetheless, Rüst does posit a shortcoming in the creation's formational economy that must be compensated for by divine action. Even though the requisite capabilities may be present, the probabilities for their successful use are, in Rüst's judgment, far too low. So, while Rüst does not call for God to leap across capability gaps, it would appear that he does call for God to jump over improbability hurdles. The difference between gaps and hurdles strikes me as too little and too subtle. Whether certain formational capabilities are missing, or merely ineffectual, God is called upon to compensate for what the creation lacks.

Notes

¹For a development of the idea of *functional integrity*, see my essay, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," *Science and Christian Belief* 8, no. 1 (April 1996): 21–38. For a critique of a perspective that rejects this idea, see my chapter, "Intelligent Design: The Celebration of Gifts Withheld?" in *Darwinism Defeated? The Johnson-Lamoureux Debate on Biological Origins* by Denis O. Lamoureux, Phillip E. Johnson, et al. (Vancouver: Regent College Publishing, 1999), 81–90.

²The Robust Formational Economy Principle is discussed in several of my writings: (a) "The Fully Gifted Creation" published as a chapter in *Three Views on Creation and Evolution*, ed. J. P. Moreland and John Mark Reynolds (Grand Rapids, MI: Zondervan Publishing House, 1999), 161–247, (b) "Science & Christian Theology as Partners in Theorizing" published as a chapter in *Science & Christianity: Four Views*, ed. Richard Carlson (Downers Grove, IL: InterVarsity Press, 2000), 196–236, and (c) "The Creation: Intelligently Designed or Optimally Equipped?" published in *Theology Today* (October 1998): 344–64.

³Howard J. Van Till, "What Good is Stardust?" published in *Christianity Today* (August 6, 2001): 52–6.

⁴See Three Views on Creation and Evolution, 189–90.

⁵However, I find no merit in Rüst's extension of this, by appeal to Psalm 104:29–30 and Matthew 10:29, to mean that God "arranges births and deaths of individual animals."

⁶Perhaps the temptation to include divine action as an element in scientific theorizing is a consequence of thinking too narrowly of divine action in the traditional vocabulary of supernatural intervention.

⁷The following two books by David Ray Griffin would provide excellent introductions to process theology and its engagement with the natural sciences: *Reenchantment Without Supernaturalism: A Process Philosophy of Religion* (Ithaca: Cornell University Press, 2001) and *Religion and Scientific Naturalism: Overcoming the Conflicts* (Albany: SUNY Press, 2000).

⁸A news report on the glycolaldehyde observation can be found at the website for the National Radio Astronomy Observatory <www.aoc.nrao.edu/pr/sugar.html>. A list of 110 observed molecules and information regarding glycine can be found in the review essay, Lewis E. Snyder, "The Search for Interstellar Glycine," Origins of Life and Evolution of the Biosphere 27 (1997): 115–33.

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