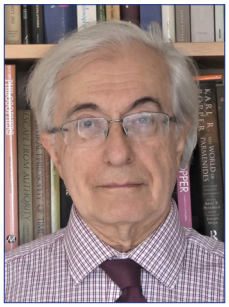

Peter J. Bussey

How Might God Have Guided Evolution? Scientific and Theological Viewpoints

Peter J. Bussey

Recent contributions to this journal by J. B. Stump, Chris Barrigar, and Randy Isaac discuss two related questions: that of God's intention to use an evolutionary process to create human beings, and whether God may have actively guided this process. I offer a more detailed analysis of the concepts of quantum complementarity and cognitive dualism used by Stump to differentiate the scientific narrative from the theistic. Both of these concepts need to be qualified, and I conclude that the theistic and scientific pictures can be kept together. The theistic account is well articulated within a creation framework. In the evolutionary account, the presence of mentality in higher animals is an important but neglected element, which will affect the scientific description. If the process of evolution was guided by God, an influence on animals' behavior through their mental nature is an attractive option. However, the matter remains open as to whether this actually happened.

The subject of human evolution continues to provide much debate among Christian thinkers. In a recent paper in this journal entitled "Did God Guide Our Evolution?," J. B. Stump discussed a number of ideas in connection with how we came to be here.[1] Correspondence followed from Randy Isaac and Chris Barrigar,[2] to which Stump responded.[3] My aim in what follows is to examine in more depth some of the issues that were raised, and to suggest a further proposal which, as far as I know, has not been in wide circulation.

The first chapters of the book of Genesis contain the traditional scriptural account of God's creation of the world and of human beings. Genesis 1 presents the process in the form of a historical narrative, with a series of creation events taking place in time under God's direction. These culminated with the human race, and each stage nominally took one day. The literary style of Genesis 2–3, focusing on the first human beings, is more that of a legend with spiritual content. The challenge for Christians and other believers is to combine a reasonable interpretation of these texts with the modern science-based account of the evolution of living species on this planet, a process that took many millions of years.

A viewpoint framed entirely in terms of science will exclude the biblical narratives and might imply, some would say, that there is nothing special or significant about our own species that requires explanation. But few of us are really willing to dismiss human significance so totally, and the biblical texts provide a perspective in which the world, that is to say the universe, was created with our appearance as a major primary goal.[4] The relevant questions are then whether we are indeed here by God's intention, how this may be related to the scientific description, and whether the standard evolutionary biological processes were

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sufficient to accomplish our appearance without additional assistance.

Stump examines several approaches to these issues, with a discussion that fluctuates between the question contained in his article's title and that of God's purposes in creating the world. These are separate questions: one can believe as a matter of faith that our human presence on Earth is part of a divine plan, but with or without divine guidance of evolution. His basic statement is that there are two relevant narratives: one concerning the scientific account of evolution, and one concerning God's intentional creation of human beings. He is content to maintain both these narratives as different portrayals of the same subject-matter, both containing truth and neither complete in itself—but not to be combined into a single discourse. The question of whether God guided the evolutionary process is not clearly answered.

To consider that the evolutionary process may have been guided by God in some way might seem to involve introducing a "God of the gaps," something that Christian believers have learned to be very cautious about. Historically, there was a tendency to use gaps in the current scientific understanding to indicate that a nonscientific agency must be acting, namely God. However, whenever a "gap" was later filled by improved scientific knowledge, the associated argument for God's action and existence became discredited. This situation can be defused by seeing God as the author of the laws and regular processes of nature, which in themselves show the divine glory. The question then becomes whether God acted exclusively by means of these laws and processes, including Darwinian evolution, or in special ways as well.

I will not attempt to discuss reasons for or against believing that we are here with a purpose. The processes of evolution do seem to have given rise to our existence, and I assume with Stump that we are indeed here by God's purposeful intention.

Arguments from Complementarity and Dualism

The two statements we will consider first are that the evolutionary process occurred historically, and that at the same time God intentionally created human beings in the divine image. They express two different ways of thinking; can we actually hold them both? To assist this, Stump made recourse to the idea of "complementarity," an approach that was supported with some reservations by Isaac in the subsequent exchanges.[5] It is a concept that finds a certain kind of scientific plausibility by reason of its centrality in quantum physics. Can it properly be transferred into a different context, though?

When a quantum object, such as an electron or a photon, is said to have wave-like or particle-like properties, this usually means that it can be in a "wave-like" state, covering an extended region of space and possessing a well-defined wavelength, or else it can be in a "particle-like" state, occupying only a small region of space and without a definite wavelength.[6] These two types of quantum states have different mathematical descriptions and may be called "complementary." What state the electron, say, is in depends on its physical history. We can carry out a measurement on the electron and are free to choose what type of measurement to make. If we take an electron in a wave-like state and measure its wavelength, all is plain and clear. If, instead, we insist on measuring a definite position of this wave-like electron, the measurement will indeed return a well-defined position value, but it will be random.[7] Now, this is nothing at all like the kind of coexisting descriptions that Stump seeks to apply to our human story. A quantum object cannot be in two complementary states at the same time. This follows from the mathematics of the quantum wave function, and not just from the practical impossibility of two simultaneous but different measurements.

In contrast, Stump's two discourses of human history are to be taken as simultaneously true, even though they are conceptually different. He describes this position, following the philosopher Roger Scruton, as "cognitive dualism," which in plain words means that "there are two different ways of looking at the matter."[8] Note that once this is expressed in Anglo-Saxon vocabulary rather than Latin, it becomes evident that there is nothing very special about the number "two," and there might well be three or more ways of looking at something! In the present case, just two ways are of interest, but we should be generally wary of assuming a dualistic constraint. (Sets of more than two mutually complementary quantum-mechanical states exist.) Let us be really clear here: quantum mechanics does *not* say that the

electron can actually possess both a localized "particle-like" property and an extended "wave-like" property at the same time, but they are not simultaneously observable. The electron *cannot* possess the two attributes at the same time. In other words, we must say that with regard to complementarity, a quantum object has to be assigned "ontological dualism," rather than a mere "cognitive dualism."[9] It is the latter term that Stump wishes to apply to the two views of our human historical condition.

Stump rightly stresses that biological evolution and divine creation must both be considered as factual realities. In this respect, I do not think he has convincingly distanced himself from Stephen Jay Gould's NOMA,[10] even though an unbeliever or agnostic might claim that religion is about questions of meaning and value and is essentially subjective. Does this really shortchange the religious position? A Christian believer can validly assert that these human perceptions relate very much to factual realities,[11] and so I do not see that there is necessarily a disagreement here between Stump and Gould. If Stump's position is effectively that of Gould, theologically repackaged and strengthened, it may not be any the worse for that.

However, if there are two different ways of looking at a given matter, it may or may not be possible to hold them both in mind simultaneously. For example, it may be humanly impossible to view a pointillist painting simultaneously as a picture of something and also as a large assemblage of small dots of paint, even if we know intellectually that both descriptions are true. But, in the case of human evolution, and in disagreement with Stump (it would seem), I see no clear reason why we should not view the subject in both the stated ways at the same time. That is, we may consider the evolutionary process as a scientifically described sequence of events, and also consider it with wonder as something divinely intended. To view with both eyes, as it were, rather than just with either the one or the other, may give a more complete three-dimensional picture. Is there really such an incongruity between the scientific and the God-based view of evolution that we need to follow Stump and invoke exclusive cognitive dualism? I would question this.

In short, we need to distinguish between "inclusive" and "exclusive" dualism. In the inclusive cognitive case, which I suggest applies here, both viewpoints can be considered simultaneously, that is to say, in parallel. This is not so in an exclusive case in which the two viewpoints are logically disparate or categorically incompatible, although they are both considered to be true. Quantum complementarity is a case of exclusive ontological dualism.

Niels Bohr and Complementarity

A certain looseness in the use of the concept of complementarity is often found in various writers, but this may perhaps be forgivable. The physicist Niels Bohr can be credited with introducing this term into the popular vocabulary. He played an important role in the middle decades of the twentieth century in educating the world about the new theory of quantum mechanics, in which the concept of complementarity was central. In talks and essays, he also endeavored to extend the idea to other areas of life, but not always with complete clarity. A thorough survey of Bohr's thinking was given some time ago in this journal by Jack Haas,[12] and was cited by Isaac; here I summarize a few key points that indicate the range of Bohr's ideas on this subject.

In a 1938 essay, "Natural Philosophy and Human Cultures," Bohr wrote:

> Using the word much as it is used, in atomic physics, to characterize the relationship between experiences obtained by different experimental arrangements and visualizable only by mutually exclusive ideas, we may truly say that different human cultures are complementary to each other.[13]

But this is quite an extrapolation! In quantum physics, we are measuring a single physical object in alternative ways, whereas different human cultures are different objects of study.

Bohr also saw complementarity between the description of the physical-chemical processes in a living creature, and that of the living creature's behavior as a whole.[14] Another proposed application was in human societies, in the exercise of justice but also of charity.[15] This might lead Christians to wonder whether God's justice and love are also "complementary"; another question might be whether the term may be applied to God as both acting within time and possessing a timeless, eternal existence. A further suggestion from Bohr concerned determinism and free will in humans, but when invoking

complementarity in connection with mental processes he was a little more circumspect.

> The indispensability of … apparently contrasting means of expression to the description of the richness of [human] conscious life strikingly reminds us of the way in which elementary physical concepts are used in atomic physics. [However,] psychical experience cannot be subjected to physical measurements.[16]

Even so, he considered that in this area, "thoughts" and "feelings" are in a complementary relationship.[17]

Some of Bohr's extensions of complementarity beyond physics may be appropriate, but they often seem to lack precision,[18] and reactions to his ideas have tended to be cautious. As Isaac and Stump remind us, the use of "complementarity" to assert the validity of two different descriptions of something does not in itself mean that we have understood anything about the relation between them. The language of both accounts can be legitimate, and the reference to complementarity offers reassurance that apparently contradictory statements may be acceptable, but it does not resolve any questions. Despite Bohr's aspirations toward "unity of knowledge," a reference to complementarity does not actually unify anything. The unavoidable conclusion is that parallels between quantum physics and other areas should be made only with great care. There is usually no need to invoke quantum complementarity in order to assert the truth of different points of view on a topic. Even as an analogy, it may mislead, since every area presents its own particular issues to be addressed. Above all, as a physicist, I would urge that scientific language should not be used metaphorically.

Interestingly, in one of the topics used by Bohr to illustrate "complementarity," a more appropriate quantum comparison was available, namely, in the relation between whole and parts. These two levels of description of a system, for example, in living creatures as Bohr said, are very different. A compound quantum object has its own existence as a physical whole, in addition to that of its constituent parts; for example, a hydrogen atom behaves as a quantum object in its own right, while also being composed of a proton and an electron. This is not properly a complementarity relationship, and the quantum physics here can usefully remind us that a purely analytical approach to a topic may be erroneous. So, perhaps a holistic view of the evolutionary process may carry information that is not perceivable in the analytical details—something that Stump seems to suggest, although it needs further argument. It also means that traditional materialistic physicalism, with its analytical insistence on identifying everything with its elementary constituents, can no longer be claimed as a standard template for rational thinking. The fact that holistic and constituent aspects of a system can both be present seems to be a good example of inclusive ontological dualism.

In evaluating Bohr's examples, it would be instructive to assign each to an ontological or cognitive category, exclusive or inclusive. This is not the subject of the present paper, but I hope that the above discussion has convincingly shown that a simple invocation of "complementarity" is not always helpful in describing a dualistic situation; it may well just impart a superficial note of scientific respectability while explaining nothing. Where, then, does this leave us in examining human evolution? Stump stressed in his reply to Isaac that he was making no attempt to relate the evolutionary process to God's purposes, but simply to assert the presence of both, in language aimed at supporting the *absence* of an explanation. This avoids any suggestion as to whether God guided evolution. But is it really best to leave matters so completely indeterminate? It seems to me that such a position is too easy an option, and it will not help Christians in conversation with skeptics. Inclusive cognitive dualism is more helpful, as we shall now see.

Creation and Its Completeness

Having argued that a scientific picture and theological insights can be viewed in parallel, we now turn to consider the scientific account in a more theological light by looking at the subject of creation. Genesis 1 suggests that the creation of the world was completed in a series of day-long stages, six in all, starting with basics and culminating with human beings. Modern science rewrites the order and detailed content of these stages and reassigns the timescales, but the general conceptual framework still seems valid. In fact, although the Hebrew word *yom* used in Genesis 1 is naturally rendered as "day," it can have a much more flexible connotation. Creation's "days" can be interpreted symbolically, and the Hebrew tradition has placed much emphasis on honoring the Sabbath on the seventh day of the human week, but

as representing a cosmic period of rest, marking the completion of God's work of creation.[19] There is thus no real theological problem with the scientific view of evolution, however long it took, provided that we can view it as the work of God.

The Genesis 1 account therefore provides a theological basis for stating that God set the universe up in a definite and particular way, starting with physical matter and a given set of physical laws and constants of nature—a "nomological" approach, in Stump's terminology.[20] This completed the physical creation. The laws had to be sufficiently substantive to provide governance of the ensuing natural processes; "laws" that are purely descriptions of nature can have no effect on anything. Stump and Chris Barrigar reached an agreement that such a viewpoint should not be rejected as "deistic." Deism, as commonly interpreted, refers to the idea that God created the universe but became a passive onlooker as to how it all played out. A passive deity is incompatible with Christian teaching, in which God interacts with human beings. The latter can clearly still be affirmed.

Even biology can be implicit in the initial Big Bang, if the assumption is made that it reduces to physics. God set it all up to go right: the physical constants and laws were sufficiently well chosen or "fine-tuned" to carry within them the processes of life. A central probabilistic aspect affects how biological evolution unfolds, but the law-guided random processes eventually worked out to produce advanced living creatures. This orthodox position is effectively that of Barrigar,[21] and also of Charles Darwin, Aldous Huxley, Richard Dawkins, Stephen Jay Gould, and a host of others, apart from the theological perspective. We humans are intelligent and have other good qualities, such as a capability for love; the assumption is made that the evolutionary processes will generate all this, at least on one planet in the universe. It might be initially undetermined as to whether the most advanced creatures would turn out as bipedal mammals, or whether some other biological form might emerge; however, this is a matter of debate.[22]

But the process of divine creation was not finished with the initial physical set-up! Only with the emergence of a race with spiritual qualities could human creation be considered as fully complete. At the biological level, detailed studies of human anatomy and DNA leave no room for doubt that we have a lineage connecting us to earlier animal species. This is confidently stated despite an incomplete understanding of how the most advanced known prehuman primates, the australopithecines, gave rise relatively quickly to the first human-like species, *Homo erectus*. This apparent "evolutionary jump" occurred around two million years ago. From *Homo erectus,* further human-like species developed, such as the Neanderthals and Denisovans, and finally our own race, *Homo sapiens*. Our biological history was now complete, but this does not include our spiritual nature, implying personhood and relationship with God. Something more was required in this respect.

This leads to questions as to how to interpret the Genesis figures of Adam and Eve as denoting the first true humans: if and when such archetypal figures historically existed, and whether as individuals or collectively. Some Christians believe that Adam and Eve are to be envisaged as the first members of *Homo erectus,* while others propose a later identification or nothing specific at all. This topic has been the subject of extensive discussion, including in the present journal, and will not be pursued further here,[23] but it is an important part of our creation story.

The Relevance of a Mental Factor

There is a further factor. Advanced living creatures have conscious minds, and this is not something physical: the laws and principles of physics have nothing to say about such a phenomenon. I diverge here from those who claim that mentality can "emerge" from physical nature; it is something qualitatively different, a new element that enters into living creatures by some means when they become able to accommodate it.[24] The full emergence of human beings on Earth is now seen to require the physical universe, the relevant evolutionary biology, a possession of mental qualities, and finally their establishment as spiritually endowed beings.[25]

Three distinct stages of development are therefore apparent: large numbers of evolved animal species with no mentality, a reduced number with mentality, and, finally, the human race with spirituality, in concordance with the biblical concept of "body, mind, and spirit." It seems likely that many animals have conscious minds, albeit not so advanced as our own. Taking this as completely evident, the philosopher Thomas Nagel famously wondered, "What

is it like to be a bat?" Some of the most conclusive evidence for animal minds comes from strong indications that some species possess self-awareness, which is investigated by observing animals' behavior in front of mirrors. Most species do not seem to have self-awareness; I have observed a small bird engaged in a ferocious battle against its own image in a shiny car hub-cap! But even without self-awareness, it is highly reasonable to suppose that mentality occurs fairly frequently in the most developed animal species on our planet.

The philosopher William James pointed out that consciousness must have a functional role in the processes of life or else it would not have evolved.[26] James was primarily concerned to demonstrate that the conscious mind cannot be just an epiphenomenal feature but must actually *do* something that is useful. At the same time, his argument makes it equally clear that a full understanding of the processes of evolution requires the purely physical and chemical considerations to be augmented by mental considerations as well. We might imagine, for example, that the presence of conscious mentality would enhance an evolutionary selection for intelligence, since this quality may be employed more effectively with a conscious mind. This means that an analysis that considers only the role of physics, chemistry, and biology should not be expected to describe accurately the rates of evolution of conscious animal species.

It hardly needs saying that we do not know with any certainty where the boundary between consciousness and nonconsciousness lies in the chain of animal life, nor do we know how to evaluate its evolutionary functionality with any accuracy. We do not even know how mentality and the physical processes in the brain interact, but a substantial paradigm shift from a purely physical model is needed. Therefore, it is hardly surprising that most discussion of this area turns out to be very imprecise, if it takes consideration of mentality at all. I cannot add precision here, unfortunately, but it is important to be aware of the issue.

The process of creation could thus have been *physically* completed with the Big Bang and the laws of physics. The evolution of nonconscious life could then be an outcome and extension of the process of physical creation, on the assumption that this was sufficient. But creation would not yet have been complete with regard to advanced animal life, which would require the provision of mentality at a later period. Finally, the human race had to be spiritually endowed. The picture now becomes decreasingly "deistic," because the later aspects may be supposed as requiring active divine involvement after the physical start of the universe.

The Possibility of Physical Guidance to Evolution

We are now better equipped to consider the original questions of this article. Our biological understandings have advanced substantially over recent decades, and this can be expected to continue. The basic question would be whether these understandings provide a good basis for believing that processes of a traditional Darwinian kind were sufficient to generate our species over the measured time-spans. If a detailed examination were to lead to this conclusion, then no additional kind of process would be indicated, in particular, divine intervention or "guidance." The answer to the question "Did God Guide Our Evolution?" would be simply "No."

A definite conclusion of this kind could be hard to reach in view of our limited scientific knowledge. It is taken as the default scientific position, however; a present failure to understand some points is hoped to be rectified by later science. But if only physical and chemical processes are taken into account, the evolution of the most advanced animal species is presumably *not* likely to have occurred on the observed timescale, since contributions from animal mentality will also be relevant. This additional factor is again probably beyond our current ability to estimate.

What if it were possible to decide that the natural resources were insufficient, taking everything into account? As the titles of Stump's article and the present article imply, there have been proposals that God might have acted to get the evolutionary processes to work as desired. Stump calls this a "causal joint strategy," and gives particular consideration to the proposal that, since quantum processes are to a large extent random, God could have imposed definite outcomes on some of them in order to achieve particular genetic mutations. The desirable random mutations are always physically available at some level of probability, and this kind of divine action would give perfectly possible results to the quantum processes, although they might be unlikely, with nothing in contradiction to the laws of physics.

It amounts to an imposition of additional form on the randomness. Perhaps there is nothing to object to here; probabilistic laws do not govern nature rigidly, and an addition to nature is not a contravention of nature. But as Stump correctly says, it is still an "intervention," albeit a rather subtle one.

Detailed proposals along these lines were made by Robert J. Russell.[27] In fact, "quantum mutations" are not so easy: mutations are more complex events than just making an electron do this or that. A mutation involves modification, removal, addition, or reconfiguration of molecular groups (base nucleotides) within the DNA structure in a cell, and can arise from processes that are somewhat distant from a pure quantum event. One could simply assert that quantum or no quantum, God just does it! But it should be remembered that if God were to cause a mutation, by any means at all, this would be a constraining act on nature and thus a further creative act on top of the already created physical processes, which we might have supposed were complete.[28]

Rather than comparing divine guidance to the ideas of René Descartes about the pineal gland, I think a better comparison is with Isaac Newton's suggestion that a divine hand was needed to keep the outer planets stable in their orbits around the sun. Later, with improved mathematical techniques, Pierre-Simon Laplace showed that this was not necessary, and he had "no need of that hypothesis." An imposed physical force on the planets, as Newton proposed, might seem very much an artifice, implying that the original laws of nature did not quite serve their purpose. Newton could perhaps have argued that laws of nature are absolutely splendid things, but they are crude instruments for something so delicate as a solar system, and there would be nothing wrong with a requirement for fine extra adjustments.[29] In the evolutionary process, if God wished to direct special creative mutations from time to time in this manner, there are likewise no logical grounds for objecting. But such suggestions do seem to imply that the work of physical creation was not as complete in its initial formative stages as might have been supposed. This might seem unsatisfactory.

A Better Proposal?

A means for divine guidance that could fit more seamlessly and even implicitly with the created natural order might seem more attractive. I am not arguing that it necessarily occurred, but if it did, we might think along the following lines. How does God normally communicate with us as human beings? Christians would first reply that there are special types of communication and miraculous intervention, as recounted in the scriptures, which have occurred from time to time over the centuries. Perhaps they are even fairly frequent. But on a daily basis, many of us would assert that God guides by means of mental impulses of various kinds—feelings of rightness or wrongness, alerts to various possibilities, and so on. In particular, the operation of our moral consciences may be considered as indicative of a permanent contact with God; it is a factor that has been degraded by conditions of general human fallenness but which is still normally present in us. All this, then, from common human experience, is perfectly "natural." Human beings can even exercise elements of creativity, since we are in the "image and likeness of God," and maybe God is also willing to lend a hand with this!

If God can contact human minds, there may be no clear objection to a contact with the minds of other animal species. How might this affect the evolutionary process? The evolution of more primitive species, lacking minds, would most likely proceed with no special divine influence at all, operating on physical and chemical principles precisely according to Darwinian and post-Darwinian understandings of natural selection. But the evolution of higher species might be influenced positively through mental contact, if God found it advantageous to incline individuals or groups to particular types of behavior. For example, it might be beneficial if particular pairs of animals could be induced to breed together to produce offspring with certain enhanced characteristics. These would presumably not be detrimental to the animals' survival or reproductive capability, but might assist these features or be helpful for the longer-term development of the species, according to a divine plan. Another possibility might be to incline groups of animals to migrate into more challenging environments such as would induce the development of more advanced biological adaptations, again with positive longer-term effects.

Mentality, presumably, normally operates according to created laws and principles. But it is also something specific to individuals, and it may be that divine contact with individuals is not a disturbance to

whatever natural principles are operating. Animals can receive communication from other animals, and so why not also from God?

This type of divine guidance, if it occurred, could have had an effect of accelerating evolutionary tendencies that might have been otherwise too unlikely or too slow to be useful, or maybe an effect such as to induce new possibilities of evolutionary direction. Although physical creation was complete, evolution involving mental processes was still ongoing, and a special divine input could also have been present. Perhaps this was how *Homo erectus* developed in a rather short geological time out of the australopithecines? These are speculations, of course, but they do seem to bridge the gap between a purely physical-chemical evolutionary narrative and the proposals of many creationists, a gap that often gives rise to a destructive perceived antagonism between science and Christian belief.[30]

Summary

To see a divine hand behind the process of creation as a whole is perfectly compatible with forming a scientific picture at the same time. It is a matter of *inclusive* cognitive dualism, I have argued. Creation took place in three stages: physical with the Big Bang, mental, and spiritual. As far as the biological side of human evolution is concerned, we do not fully know whether the physical and chemical processes of evolution were capable of doing the job on their own, but it is a reasonable assumption, up to the point when mentality became relevant. The Big Bang, then, contained the seeds of life, but they took myriads of years to come to fruition.

Theologically, it is possible to argue that life is so special as to represent a new stage of creation, and that God might well have guided the physical process of evolution, although this viewpoint is not one that I am advocating here. But the gift of mentality in animals is a further significant factor in the evolution process, one that is definitely new, marking a new stage in which God might have exercised creative power. The imparting of spiritual identity to the human race, so that we are in God's image, was the final step in human creation.

The possibility that God may have guided evolution in some way is not just a philosophical or theological question, but one whose answer may require precise and quantitative scientific evaluation of the evolutionary workings. It is surely wrong to suppose that God's activities have to be undetectable in principle, and therefore a pure matter of faith and belief.[31] Whatever the answer here may be, none of this detracts from the overall presence of a divine purpose in the universe. I am unable to propose a clear answer to Jim Stump's original question, but if God *did* guide evolution, the possibility that it occurred through mental communications with the more advanced animals could be a relatively "natural" means by which it might have been achieved. ✞

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Notes

[1]J. B. Stump, "Did God Guide Our Evolution?," *Perspectives on Science and Christian Faith* 72, no. 1 (2020): 15–24. Hereafter *PSCF*.

[2]Randy Isaac, "Does Complementarity Explain Anything?," *PSCF* 72, no. 2 (2020): 126; and Chris Barrigar, "The *Agape*/Probability Proposal Is Not Deist," *PSCF* 72, no. 2 (2020): 126.

[3]J. B. Stump, "Response to Randy Isaac and Chris Barrigar," *PSCF* 72, no. 2 (2020): 127–28.

[4]There might be God-breathed races on other planets, but we do not discuss this here.

[5]Complementarity was also used by William G. Pollard, *Chance and Providence: God's Action in a World Governed by Scientific Law* (London, UK: Faber & Faber, 1958). Pollard's approach has some similarities to that of Stump, in that he sees the providential and scientific view of the world as complementary in approximate analogy with quantum mechanics.

[6]"State" here refers to the particle's quantum mechanical wave-function.

[7]Following this measurement, the electron will be in the resulting localized "particle-like" state, which now forms the starting point for its subsequent behavior. The original wave-like state is lost.

[8]George Orwell's "double-think" may be seen as an extreme example of cognitive dualism! George Orwell (né Eric Arthur Blair) pointed out strongly how a choice of language can affect our way of thinking and that clear honesty is essential.

[9]There are intermediate states in which the electron has some degree of both types of property, wave-like and particle-like. An uncertainty principle holds. This is well described by the relevant mathematics but is not relevant to our present argument.

[10]"Non-overlapping magisteria." That is, science and religion talk about two different aspects of reality, and both (if you are a believer) may be considered to be true.

[11]For some fuller discussion of this all-important subject, one might start with the 1914 Gifford lectures by Arthur Balfour, *Theism and Humanism* (Seattle, WA: Inkling

Books, 2000), whose ideas were taken up by others, notably C. S. Lewis.

[12]John W. Haas Jr., "Complementarity and Christian Thought," *Journal of the American Scientific Affiliation* 35, no. 3 (1983): 145–51.

[13]Niels Bohr, "Natural Philosophy and Human Cultures" (1938), in *Atomic Physics and Human Knowledge* (Mineola, NY: Dover Publications, 2010), 30–31.

[14]Niels Bohr, "Unity of Knowledge" (1954), in *Atomic Physics and Human Knowledge,* 76. One could go beyond Bohr's conceptually formulated statements and assert that sometimes it may be necessary to kill the living creature in order to understand its biochemical processes! This would clearly resemble the quantum physics where one type of experimental observation excludes another. Fortunately, biological investigations do not always need to go so far.

[15]Ibid., 80–82.

[16]Niels Bohr, "Atoms and Human Knowledge" (1955), in *Atomic Physics and Human Knowledge*, 92.

[17]Bohr, "Natural Philosophy and Human Cultures," 27.

[18]For example, Bohr's imaginative assertion that "… the impossibility of providing an unambiguous content to the idea of subconsciousness corresponds to the impossibility of pictorial interpretation of the quantum-mechanical formalism" ("Unity of Knowledge," 77).

[19]While God remains active continuously (John 5:17), the Epistle to the Hebrews emphasizes that the actual work of creation was "finished from the foundation of the world" (Heb. 4:3).

[20]On at least one planet in the universe, one might add.

[21]Chris Barrigar, "God's *Agape*/Probability Design for the Universe," *PSCF* 70, no. 3 (2018): 161–75. Barrigar calls this "front-loading" the universe. His stress is on an evolutionary universe that will generate creatures capable of love.

[22]Simon Conway Morris, in his *Life's Solution: Inevitable Humans in a Lonely Universe* (New York: Cambridge University Press, 2004), proposes a theory of *convergent evolution* in which certain standard forms and patterns often evolve in different groups of species. This may happen in different environments of a given type, and it is as if evolution tends to operate according to a number of overall rules and tendencies. The formation of human-like creatures might then be expected, if one knows what these rules are. This would remove some of the unpredictability in the evolutionary process and would make the operation of a plan appear less contradictory to the randomness that is often assumed to be fundamental in evolution.

[23]I discussed this in a recent article, "Natural Law— 'God's Law in our Hearts,'" *Science and Christian Belief* 32, no. 1 (2020): 5–28.

[24]For an introductory discussion of this topic, see Christof Koch, "Is Consciousness Universal?," *Scientific American Mind* 25, no. 1 (2014): 26–29. I do not necessarily agree with all of this author's views, but he raises some relevant issues. A version of the philosophy of panpsychism is sometimes put forward in which everything is said to be "enminded"; this goes beyond anything that is proposed by Koch or by myself and seems to be hard to define and harder to verify. The atheist philosopher Galen Strawson is an advocate of panpsychism; see "Realistic Monism: Why Physicalism Entails Panpsychism," in Galen Strawson, *Real Materialism and Other Essays* (New York: Oxford University Press, 2008), 53–74.

[25]Body, mind and spirit, to use the scriptural picture.

[26]William James, "Are We Automata?," *Mind* 4, no. 13 (1879): 1–22.

[27]Robert John Russell, "Special Providence and Genetic Mutation: A New Defense of Theistic Evolution," in *Perspectives on an Evolving Creation*, ed. Keith B. Miller (Grand Rapids, MI: Wm. B. Eerdmans, 2003), 335–69.

[28]Russell and others believe that an intervention is allowable only if undetectable, because then the mutation *could* have occurred naturally. I find this a little strange. Is God really in the business of hiding his activities? Very possibly, an intervention could have a certain high level of Bayesian probability assigned to it compared to that of the "natural" event.

[29]Indeed, we may still wonder at the fact that our planetary system has been sufficiently stable over so many millions of years—this is a highly technical question, however, involving a chaotic element to planets' behavior, and no astronomer would advocate Newton's solution to it nowadays.

[30]This proposal appears to be almost a mirror image of that of Russell, "Special Providence and Genetic Mutation," 366. He suggests that God acts in various ways in quantum genetic events, but when animal consciousness appears, in this respect the animals are left to run their own affairs. He then raises the issue of animal suffering over the aeons. If quantum mutations were God's way of guiding evolution, one might have hoped for more interventions to ameliorate this. It is a serious problem.

[31]Certainly, the writer to the Hebrews did say that it is by faith that we believe that God created the universe (Heb. 11:2). Since then we are living in God's "Sabbath rest" (Hebrews 4). But once this has been accepted, there is no logical need to propose that God's activity in the world is always invisible.