Brendan Purcell, *From Big Bang to Big Mystery: Human Origins in Light of Creation and Evolution*. Hyde Park, NY: New City Press, 2012. Pp. 365, $34.95.

Paul O'Hara
Northeastern Illinois University

I first became aware of tensions between certain religious and Darwinian perspectives when as a child I watched the movie *Inherit the Wind* about the famous Scope's trial. It seemed strange to me at the time, because I grew up in (Catholic) Ireland where the theory of evolution was considered a natural phenomenon related to the origin of species. Evolution was not a huge issue and our faith was not shaken because of the theory.

On arriving in the United States, I soon became aware that the issue was as contentious as ever. It seemed as if the Scope's trial was still an unresolved issue. One side stringently defended a literal interpretation of Genesis, and the other side supported a rather agnostic perspective in which only strict Darwinism was allowed. As a Christian and a scientist, I was baffled by this division. I have always believed that the religious and scientific perspectives should complement rather than oppose each other and that a serious dialogue was needed. Later, I became aware of the work of The Chicago Center for Religion and Science and its publication *Zygon*, and of the Center for Theology and the Natural Sciences at the Graduate Theological Union in Berkeley, both of which provided a forum for this type of discussion. Nevertheless, in spite of their work, I remained convinced that a new unified approach was needed which would bridge the two views in such a way that both sides of the debate would feel respected and mutually enriched. I am happy to say that with the publication of Brendan Purcell's *From Big Bang to Big Mystery*, such a bridge has been constructed.

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A Brief Overview of the Book

This book, although divided into five Parts, operates on two levels. It operates primarily on a metaphysical level as a philosophical anthropology. This is already clearly affirmed in Part One, and again in Part Five. In Part One, Purcell lays out the philosophical components of what it means to be human. They define, so to speak, the Alpha and Omega of the book in which we move from the compactness of myth, through the Greek, Jewish, and Christian experiences of humanity to an even more fully differentiated understanding rooted both in the Christian experience of *kenosis* and the discoveries of the natural and social sciences. To paraphrase Abraham Heschel (49), the Greek experience can be summarized as the human person seeking the transcendent, while the Jewish and Christian experiences can be characterized as the transcendent seeking the human person. In the end, it is this mutual quest that

characterizes us as human. The reader is continually challenged to undertake the quest for his or herself. Indeed, in the last Part of the book, after having worked through what the natural and social sciences tell us about human origins in Parts Two through Four, Purcell concludes by reaffirming the uniqueness of the human quest for meaning, noting that this quest for meaning defines who we are. It is a "big mystery" that can only reach fulfillment when we seek communion with one another and with the transcendent.

In Part Two, Purcell explores the scientific method and attempts to integrate the scientific picture that emerges with evolution with the philosophical quest for meaning. What emerges is not some random set of events governed by chance, but a "fined-tuned universe" that seemed to know we were coming. This scientific understanding is explored more deeply in terms of "Darwin and the evolution of evolution." The play on words here is to draw our attention to the fact that many have contributed to a theory of evolution; and that there are very different understandings of how evolution takes place that are not all in agreement with Darwin's notion of natural selection. Indeed, the principle methodological tool developed by Purcell in this book is in terms of the laws of emergent probability, as conceived by Bernard Lonergan in his book: *Insight: A Study of Human Understanding*.

In Part Three, Purcell discusses the different types of hominids that have been discovered focusing particularly on the Neanderthals, since they are considered to be the closest to humans. However, from Purcell's perspective they are far from being human because there is no evidence of them ever taking on a quest for meaning. They do not seek the transcendent. This stark difference between us and the other hominids is referred to as a "human revolution" in that with the emergence of *homo sapiens*, there emerged "'something entirely new,' with a difference not just in degree but in kind" (184).

This sets the stage for Part Four of the book where Purcell focuses on seven human characteristics that make humans distinct. These are (1) the genetic "African Eve and Adam," (2) our culture-oriented body plan, (3) our meaning-oriented brain and vocal tract, (4) symbolization, (5) language, (6) understanding, and (7) freedom. Finally, the aspects of human understanding and freedom are explored more deeply in terms of: "The human person's limitless orientation to horizons of beauty, meaning, truth and goodness" (269).

With Part Five, we reach the Omega point of the book. Here, all the elements discussed in the previous Parts are woven together into explaining the human being as a "Big Mystery" who finds meaning in a never-ending quest for meaning oriented to communion with others "[grounded] in a transfinite You" (324). This final part primarily focuses on the external causation of the universe. It is supported by the parts of the text that focus primarily on the internal causation of the universe as understood by the natural and social sciences governed by the laws of emergent probability.

External and Internal Causation

On page 81, Purcell introduces his first methodological tool. Borrowing from Lonergan, he distinguishes between "external causation" (primary causation) and "internal causation" (secondary causation). He notes that "again and again, many of what are treated as irreversible conflicts between science and religion, or science and philosophy, are due primarily to the failure to make this distinction between two quite different levels of causal explanation" (81–82). Indeed, I would suggest that this is the key

to understanding everything that follows. It serves not only as a principle that unifies the whole text, but also permits a dialogue between philosophy and science to take place as the text unfolds. For the remainder of this review, I will focus primarily on this dialogue.

Internal causes are strictly related to the scientific method. Following Lonergan, Purcell notes that there is a hierarchy in the order of emergence in which different levels of existence emerge in accordance with the rules of emergent probability which are governed by principles of emergence, correspondence, finality, and development. Emergent probability can be loosely defined as a conditioned sequence of schemes of recurrence that result from a methodological juxtaposing of the classical and statistical laws that ground physics and chemistry, and from a similar juxtaposing of classical, statistical, and developmental laws that ground the biological and psychological sciences. Moreover, if these schemes can be empirically verified as existing in the natural order, then in accordance with scientific method we have constructed a model that grounds the existence of things in a contingently ordered structure where later things are chronologically dependent upon what went before them. This is one of the key ideas of Darwinian evolution.

For example, planetary motion can be seen as a scheme of recurrence that grounds a solar system. The occurring and recurring patterns in the laws of chemical bonding allow us to distinguish water from hydrogen and oxygen. Indeed, the whole theory of "chemical bonding" rests on identifying a remarkable set of patterns associated with the periodic table and noting that these patterns associated with the laws of valency define simple rules that ground the existence of molecules. In terms of biology, the Krebs cycle can be seen as a bio-chemical scheme of recurrence that transfers energy to the cell to maintain it in life.

To better understand what it means for these schemes to be conditioned, let us consider Newton's laws of motion. They explain well the motion of the planets. They also describe the motion of billiard balls on a frictionless table, and ideally from one perspective they explain the motion of ideal gas particles in which particles of the gas collide with each other. However, there is a catch.

Consider two different sets of ideal gas particles both at different temperatures, composed of hydrogen gas in one container and oxygen in another. When the gases are mixed, not only do they move according to Newton's laws but something else happens. They exchange heat energy until both are at the same temperature in accordance with the second law of thermodynamics. Moreover this process is not reversible. It is next to impossible, especially in a closed system, to have them return to their earlier state. This contrasts with the set of billiard balls on a frictionless table where one can in principle reverse the direction of motion of all the billiards and have them return to their initial state. Not so with mixed gases. In this case, the emergence of the mixed gas system presupposes Newton's laws; but in addition it does not prevent another seemingly unrelated thing from happening, namely, the flow of heat energy from hot to cold until the system reaches equilibrium. One could say that from the perspective of Newton's laws, the one directional heat flow constitutes a merely coincidental manifold of events, and that the state of dynamic equilibrium which is reached is nothing more than a happy coincidence. However, once the second law of thermodynamics is introduced, often referred to as the law of entropy, the happy coincidence gives way to a contingent necessity. The law of entropy presupposes relationships between actually existing things, while Newton's laws of motion do not.

We now take the experiment one step further. Our hydrogen and oxygen gases are not only allowed to mix at equal or different

temperatures, but a spark is applied and a massive explosion occurs. Heat energy is given off and the hydrogen and oxygen molecules have now formed water or water vapor. What has happened? Not only have the gas molecules collided according to Newton's laws, but the gases interact according to the laws of thermodynamics and quantum mechanics to enable a new system of things, water molecules, to be created. Water is more than hydrogen and oxygen. The intrinsic laws of bonding associated with its architecture are also necessary to define water.

In other words, architecture is more than bricks and stones, plaster and mortar; it also requires a plan, a patterned scheme and organization. A house from the perspective of the interlocking bricks and stones is nothing more than a coincidental juxtaposing of the raw material. Indeed, if bricks and mortar are scattered at random in a confined space, in almost all cases nothing recognizable will be produced. Occasionally, dilapidated structures and ruins might be formed, but almost never will an ordered structure like a shed much less a well finished home emerge. However, that quickly changes when one considers the higher order manifold associated with the architect's plan. It is precisely because of the plan that we can pass from many scattered bricks randomly patterned to a well-designed house put together in accordance with the plan.

By analogy, emergent probability functions on the same level. It preserves both unity and distinction within the sciences. So we can pass from the physics to the chemical to the biological to the animal to the human levels of existence. This has been beautifully outlined by Purcell in his methodology. Following Lonergan, he liberates the sciences from any direct dependence upon each other, while at the same time showing that a unified methodology helps explain how lower systems of things can emerge into higher systems of things according to the laws of each science. It offers an explanation of the different genus and species as a principle of development that emerges within the process itself without in any way requiring the scientist to compromise his or her science, or asking the person of faith to compromise his or her religious beliefs. Scientists might be tempted to consider this as purely epiphenomenal, although, as the second law of thermodynamics indicates, higher laws can emerge which presuppose the existence of other laws but are not determined solely by them. It is hard to conceive of an emergent law as purely epiphenomenal. Planetary systems could have been created strictly according to Newton's laws of motion and gravity without any need for the laws of entropy. However, without the law of entropy the universe as we know it could never have evolved. In the same way, without organizing principles on the level of biology, there could not be biological organisms. Indeed, seen from this perspective, the newly emergent laws can be viewed as a "big bang" operating on the biological and psychological levels of existence.

There is something huge in the transition from chemical to the biological level. Chemical compounds once created can in principle exist independently of their environment (think of hydrogen). In contrast a biological system by definition is completely dependent upon its environment in order to breath and to feed. Biological systems are not closed systems. They are intrinsically relational and open. Moreover, just as the law of entropy is not needed for mechanics but becomes contingently necessary in order to explain a state in equilibrium, there are also biological laws that are merely coincidental from the perspective of the underlying chemical and biochemical laws but become contingently necessary in order to maintain a biological system. For example the laws of reproduction,

of mitosis and meiosis are necessary conditions of biological life. One can well imagine mammals without ovaries, but one cannot imagine reproduction without them. Living things reproduce. It is a law that cannot be explained by any underlying chemistry, although it is dependent upon the underlying laws of chemistry in some secondary way. This is even more pronounced when we move onto higher levels of existence characterized by human consciousness (Part Four), where the dictates of human freedom, while dependent somewhat on the biological and zoological levels of our existence, are nevertheless not determined by them.

So, I think Purcell has a point when he suggests that the emerging levels are not epiphenomena but constitutive of new realities on the level of a big bang for biology. His work on emergent probability helps clarify the Darwinian concept of "natural selection" (109) by transforming a vague idea into a deeper scientific concept more attuned to the concept of "punctuated equilibria" annunciated by Eldredge and Gould (125), and well attuned to the notion of a "Biological Big Bang" as described by the Russian-born US-based biologist Eugene Koonin (123), but, I would claim, in a much richer way. Indeed, Purcell's approach, motivated by Lonergan's theory of emergent probability, not only offers an explanatory tool for biology but for all of the sciences, in that the different scientific disciplines preserve their autonomy while also being methodologically related to each other.

Conclusion

Purcell's book fulfills a long overdue need which should appeal to the scientist and non-scientist alike, to people of faith and of no faith alike. It permits a dialogue between the sciences and also between the sciences and philosophy and theology. If there is a shortcoming, it is that it needed to explain "emergent probability" in a bit more detail. In particular, there is no mention of the second law of thermodynamics and its significance in terms of an overarching plan for evolution. Indeed, in terms of the second law of thermodynamics, one might ask if the whole emergent probability scheme is irrelevant in that this law states that all physical systems, including biological ones, will interact in a way that maximizes entropy which will eventually cause breakdown and death. So in future editions, it would be good to include something in the last chapter relating *kenosis* and entropy in terms of "the intersection of the timeless with time" (316), as we are drawn into the never-ending contemplation of the "Big Mystery" of existence.