[5]Peter J. Bussey, "How Might God Have Guided Evolution? Scientific and Theological Viewpoints," *Perspectives on Science and Christian Faith* 73, no. 2 (2021): 91–99.
[6]John A. Wheeler, "Information, Physics, Quantum: The Search for Links," in *Proceedings III International Symposium on Foundations of Quantum Mechanics* (Tokyo: 1989), 354–68, https://philpapers.org/archive/WHEIPQ.pdf; and John Archibald Wheeler, *Information, Physics, Quantum: The Search for Links*—PhilPapers [Index].
[7]Moorad Alexanian, "Theistic Science: The Metaphysics of Science," *Perspectives on Science and Christian Faith* 59, no. 1 (2007): 85–86.

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Failure to Engage the Problem of Life's Origin

The discussion of "simplicity" versus "complexity" in abiogenesis seems to me to be the wrong question, and fails to engage the problem of life's origin in a specific way (Emily Boring, J. B. Stump, and Stephen Freeland, "Rethinking Abiogenesis: Part I, Continuity of Life through Time," *PSCF* 72, no. 1 [2020]: 25–36; and Emily Boring, Randy Isaac, and Stephen Freeland, "Rethinking Abiogenesis: Part II, Life as a Simplification of the Nonliving Universe," *PSCF* 73, no. 2 [2021]: 100–113). For one thing, the two terms are ambiguous, and were not defined sufficiently to allow a definite conclusion.

More importantly, the article glossed over the unique feature that makes life possible, namely, its ability to reproduce something after its kind. To accomplish this (in anything less trivial than crystals) required the emergence of a novel level of being, that is, a genetic code that is "gratuitous," decoupled from chemistry. The operon model with allosteric enzymes that was discovered by Monod, Jacob, and Lwoff (Nobel Prize 1965) is, after DNA, the "second secret of life." All of life exhibits this feature, and as such it perhaps should be included in the definition of life.

Freeland's persistent emphasis on continuity in abiogenesis ignores such decoupling and discontinuous system-level features of life. I wonder why, since it is widely emphasized in the classic literature on emergence, such as in Michael Polanyi's article on "Life's Irreducible Structure" (*Science* 160, no. 3834 [1968]: 1308–1312) and Philip Anderson's essay "More Is Different" (*Science* 177, no. 4047 [1972]: 393–96). I too wrote about this decoupling feature in an article on its application to information technology. The design of the internet, for instance, includes the idea of an information "packet" that contains external routing codes and an internal message. The content of the message is irrelevant—decoupled or "gratuitous" with respect to the routing of the packet (Paul T. Arveson, "Gratuity in Nature and Technology," *Journal of the Washington Academy of Sciences* 85, no. 4 [1998]: 281–89).

The discovery of novel ontological levels in nature has, I believe, useful applications for ASA members, as a refutation of reductionism and as an awareness of category distinctions that we commonly encounter in science and faith discussions.

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"Rethinking Abiogenesis Part II" Authors Respond

We thank Arveson for raising some key points of discussion. While we do not formally define "simplicity" or "complexity," we do identify specific features of life that present lower diversity and less randomness than the universe at large. Our intent is not to declare biological complexity wrongheaded, but rather to suggest that other views are possible and worthy of deeper consideration. However, Arveson's main focus is the underlying point of both our papers (Emily Boring, J. B. Stump, and Stephen Freeland, "Rethinking Abiogenesis: Part I, Continuity of Life through Time," *PSCF* 72, no. 1 [2020]: 25–35; and Emily Boring, Randy Isaac, and Stephen Freeland, "Rethinking Abiogenesis: Part II, Life as a Simplification of the Nonliving Universe," *PSCF* 73, no. 2 [2021]: 100–113), which he accurately summarizes as the following challenge: Does any clear, objectively defined state of (bio)chemistry distinguish nonliving chemistry from living biology?

We agree that life may be distinguished clearly from nonlife from the perspective with which we perceive the world today. In particular, the Central Dogma of Molecular Biology[1] reflects five mid-twentieth-century Nobel prizes which collectively define the material (molecular) basis for all known life:[2] nucleic acid genes specify protein catalysts which synthesize nucleic acid genes. Collectively, these components establish what Arveson calls "*the unique feature that makes life possible, namely, its ability to reproduce something after its kind*." Indeed, Arveson refers to a sixth Nobel prize from the same time period—Monod and colleagues' discovery of operons, regulatory