

Readers say scientists can, indeed, knock on heaven's door

The letter by Keith Schofield in the August 2012 issue of *PHYSICS TODAY* (page 12) is a restatement of an old logical fallacy known as the “god of the gaps” argument, which goes like this:

- ▶ Science has not yet explained *X*. Therefore, it never will.
- ▶ Science can never explain *X*. Therefore, *X* cannot have a natural explanation.
- ▶ *X* must have a supernatural explanation, so it must have been caused by a supernatural being.
- ▶ That being must be a god, and of course it must be *my* god.

Scientists don't need to have the logical absurdity of that argument pointed out to them. Schofield should not need to be reminded that the business of science is to uncover the truth about our universe, not to confirm deeply held beliefs. To uncover the truth, one must be as objective as possible, without interference from emotions or prior beliefs. Schofield appears to be making exactly that mistake.

The history of science is replete with instances where the gaps, once wide and numerous, were filled in by later generations. Galileo Galilei and Charles Darwin are only two examples of prominent gap fillers.

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■ **The statement** by Keith Schofield that “we have no theory . . . on the biggest question: how life originated” needs correction. Quite the contrary, we have and continue to develop such the-

ories. They have led to a variety of experimental and analytical approaches that have yielded steady, if slow, progress in understanding that very fundamental problem. Undoubtedly, some theories are dead ends, but that does not mean that improved understanding is impossible or that the quest for it reflects “arrogance.”

Experimental approaches to the synthesis of prebiotic compounds have a long history and have produced striking results concerning the prebiotic synthesis not only of numerous amino acids and other simple compounds but also of nucleosides, the very basis of the polymers essential to life as we know it. Experiments have also demonstrated the feasibility of abiotic polymerization of such building blocks. The literature on the topic is so extensive that even a casual online search will lead to dozens of articles. That abundance does not, of course, prove a particular pathway to life itself; an experimental approach to that is probably impossible.

Such studies in no way show arrogance. They are simply a continuation of scientific efforts aimed at understanding our admittedly complex universe. That is what science does.

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■ **Keith Schofield** raises some interesting points in connection with Lisa Randall's book *Knocking on Heaven's Door: How Physics and Scientific Thinking Illuminate the Universe and the Modern World*. He makes a statement about extrapolating our meager knowledge acquired over a mere few hundred years into a broad claim regarding the intervention of a supernatural being animated with a purpose. The statement would seem to suggest he believes that at least one such problem has appeared, perhaps the question of how life could originate without divine intervention.

Although Schofield is undoubtedly justified in claiming that the question of how life originated is not presently understood, it takes a rather willful lack of imagination to believe that questions about the origin of

DNA, the genetic code, and the rise of self-replicating and evolving structures in our active chemical universe are forever unanswerable.

The issue of the chicken and the egg, which Schofield mentions, is easily addressed. Eggs have been around longer than chickens, and not all the egg-laying animals from whom modern chickens descended were in fact chickens. The relationship between short-term recurrence and long-term trending (in a thermodynamic setting) has been labeled “equilibrium” by Richard Feynman. That is when all the fast things have already happened but none of the slow things have yet. Intriguing, perhaps, but not necessarily a profound mystery.

Finally, to say that questions we currently don't or can't fully understand will never be understood and answered is, well, arrogant.

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Former student pays tribute to Wineland

Not only is David Wineland a great scientist, as the Royal Swedish Academy of Sciences recently confirmed, he is also an exceptional human being.

I had the privilege of working for Dave as a PhD student from 1997 to 2001, developing one of the first quantum computers. Our team used individual trapped ions: charged atoms suspended in vacuum by electric fields. Since the early 1970s, Dave had developed a huge range of techniques for trapping ions and controlling their quantum behavior. Our task was to go from controlling a single ion to controlling two, three, or four.

The team consisted of NIST staff member Christopher Monroe (now a professor at the University of Maryland's Joint Quantum Institute and a world leader in his own right), four postdoctoral researchers, a student nearing PhD completion, and me—the junior student. A standard university lab is lucky to have one or two postdoctoral researchers managing a herd of PhD students. Here the postdocs were the backbone of the team.

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