



Digits and Fidgets

Is the universe fine-tuned for life? By MICHAEL SHERMER

*There was a young fellow from Trinity
Who took the square root of infinity.
But the number of digits
Gave him the fidgets;
He dropped Math and took up Divinity.*

In the limerick above, physicist George Gamow dealt with the paradox of a finite being contemplating infinity by passing the buck to theologians.

In an attempt to prove that the universe was intelligently designed, religion has lately been fidgeting with the fine-tuning digits of the cosmos. The John Templeton Foundation even grants cash prizes for such “progress in religion.” Last year mathematical physicist and Anglican priest John C. Polkinghorne, recognized because he “has invigorated the search for interface between science and religion,” was given \$1 million for his “treatment of theology as a natural science.” In 2000 physicist Freeman Dyson took home a \$945,000 prize for such works as his 1979 book, *Disturbing the Universe*, in which he writes: “As we look out into the universe and identify the many

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accidents of physics and astronomy that have worked together to our benefit, it almost seems as if the Universe must in some sense have known that we were coming.”

Mathematical physicist Paul Davies also won a Templeton prize. In his 1999 book, *The Fifth Miracle*, he makes these observations

about the fine-tuned nature of the cosmos: “If life follows from [primordial] soup with causal dependability, the laws of nature encode a hidden subtext, a cosmic imperative, which tells them: ‘Make life!’ And, through life, its by-products: mind, knowledge, understanding. It means that the laws of the universe have engineered their own comprehension. This is a breathtaking vision of nature, magnificent and uplifting in its majestic sweep. I hope it is correct. It would be wonderful if it were correct.”

Indeed, it would be wonderful. But not any more wonderful than if it were not correct. Even atheist Stephen W. Hawking sounded like a supporter of intelligent design when he wrote: “And why is the universe so close to the dividing line between collapsing again and expanding indefinitely?... If the rate of expansion one second after the Big Bang had been less by one part in 10^{10} , the universe would have collapsed after a few million years. If it had been greater by one part in 10^{10} , the universe

would have been essentially empty after a few million years. In neither case would it have lasted long enough for life to develop. Thus one either has to appeal to the anthropic principle or find some physical explanation of why the universe is the way it is.”

In its current version, the anthropic principle posits that we live in a multiverse in which our universe is only one of many universes, all with different laws of nature. Those universes whose parameters are most likely to give rise to life occasionally generate complex life with brains big enough to achieve consciousness and to conceive of such concepts as God and cosmology and to ask such questions as Why? Another explanation can be found in the properties of self-organization and emergence. Water is an emergent property of a particular arrangement of hydrogen and oxygen molecules, just as consciousness is a self-organized emergent property of billions of neurons. The evolution of complex life is an emergent property of simple life: prokaryote cells self-organized into eukaryote cells, which self-organized into multicellular organisms, which self-organized into ... and here we are.

Self-organization and emergence arise out of complex adaptive systems that grow and learn as they change. As a complex adaptive system, the cosmos may be one giant autocatalytic (self-driving) feedback loop that generates such emergent properties as life. We can think of self-organization as an emergent property and emergence as a form of self-organization. Complexity is so simple it can be put on a bumper sticker: LIFE HAPPENS.

If life on earth is unique or at least exceptionally rare (and in either case certainly not inevitable), how special is our fleeting, mayfly-like existence? And how important it is that we make the most of our lives and our loves; how critical it is that we work to preserve not only our own species but all species and the biosphere itself. Whether the universe is teeming with life or we are alone, whether our existence is strongly necessitated by the laws of nature or highly contingent and accidental, whether there is more to come or this is all there is, we are faced with a worldview that is breathtaking and majestic in its sweep across time and space. **SA**

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