

The Evolution Prize: Is Open-Ended Evolutionary Innovation in a Closed System Possible?

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Astrobiology reveals that Earth's biosphere may be open to genetic input from elsewhere. How important is this potential input? Could life on Earth have originated and evolved to its current level of organized complexity without it? Is open-ended evolutionary innovation even possible in a closed system? The Astrobiology Research Trust (ART) desires to promote interest and research into this question. For a computer model that demonstrates an answer, ART will award a prize of \$100,000.

The Prize

Open-ended evolution is characterized by a continued ability to invent new properties — so far only the evolution of life on Earth (data partly from the fossil record) and human technology (data from patents) have been shown to generate adaptive novelty in an open-ended manner. — So said Norman Packard and Mark Bedau in 2003 (1). Of course human technology is an open system because it receives input from human agents. And we now admit that life on Earth also may receive genetic input from elsewhere. Therefore, the title question is not already answered by life on Earth or human technology.

Computer models can explore closed-system evolutionary phenomena more quickly than real life. If Open-Ended Evolutionary Innovation (OEEI) in a closed system is possible, a computer model should be able to demonstrate it. ART wishes to stimulate this endeavor by establishing a prize for such a demonstration.

As a first step, ART wishes to identify jurors who are genuinely interested in the title question and would like to participate. An early task will be to clarify the criteria for the prize, and consider how to administer it.

Preliminary Definitions and Discussion

Evolution. Evolution is an iterative process in which encoded instructions are executed to produce results that include the instructions for the next generation. Once per generation, the instructions are varied by some mechanism and the results undergo natural selection. Repetition of this process changes both the instructions and the results in a cumulative manner.

Innovation. Innovation is nearly synonymous with invention and is most easily illustrated by example. In biology consider the origin of life, the universal genetic code, nitrogen fixation, aerobic respiration, photosynthesis, multicellularity, etc. Other lists may be found in most biology texts.

Not Innovation. Innovation is also clarified by identifying phenomena that would not qualify, such as optimization,

puzzle-solving, gene transfer, symbiosis, emergent properties, and program switching. Beyond citing positive and negative examples, precisely defining innovation is difficult. Hopefully, the jury will not be too daunted by this difficulty.

Open-ended. If a model can achieve only one apparent innovation, after which additional innovations are not realized, nor even expected, the title question has not been answered. Assurance comes if the process continues without an obvious limit.

Consider the following conjecture: *The evolutionary potential of any system based on encoded instructions is forever limited to that provided by the available instructions. If the system is closed to additional instructions, true innovations will not evolve and the limit will be reached.* The challenge may be stated conversely: disprove the above conjecture. Does that add clarity?

Closed system. The system includes not just the applications software, but also the underlying computer operating system. It is closed if no additional instructions in any form are admitted after the evolutionary process begins. Energy and blank materials may be supplied as the model requires.

Importance. We may think that this challenge is simply to demonstrate something already known, but do we really know it? Closed-system biological models (2) have not clearly demonstrated OEEI, and logical proofs rely too heavily on the Big Bang theory. Without better evidence it is reasonable to doubt that OEEI in a closed system is possible. Therefore, an important scientific issue is also at stake.

Regardless of the ultimate answer to the title question, science should not abandon scientific principles and adopt unscientific explanations. Yet many Darwinists on one side, and proponents of creationism/ID on the other, claim that only a positive answer can be treated scientifically. This false dilemma is detrimental to science.

References

1. Rasmussen, S. et al. 2004. Transitions from Nonliving to Living Matter. *Science* 303:963-965.
2. Lenski, R. 1986. Long-term evolution experiment with *E. coli*. <http://myxo.css.msu.edu/cgi-bin/lenski/prefman.pl?group=aad>.

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