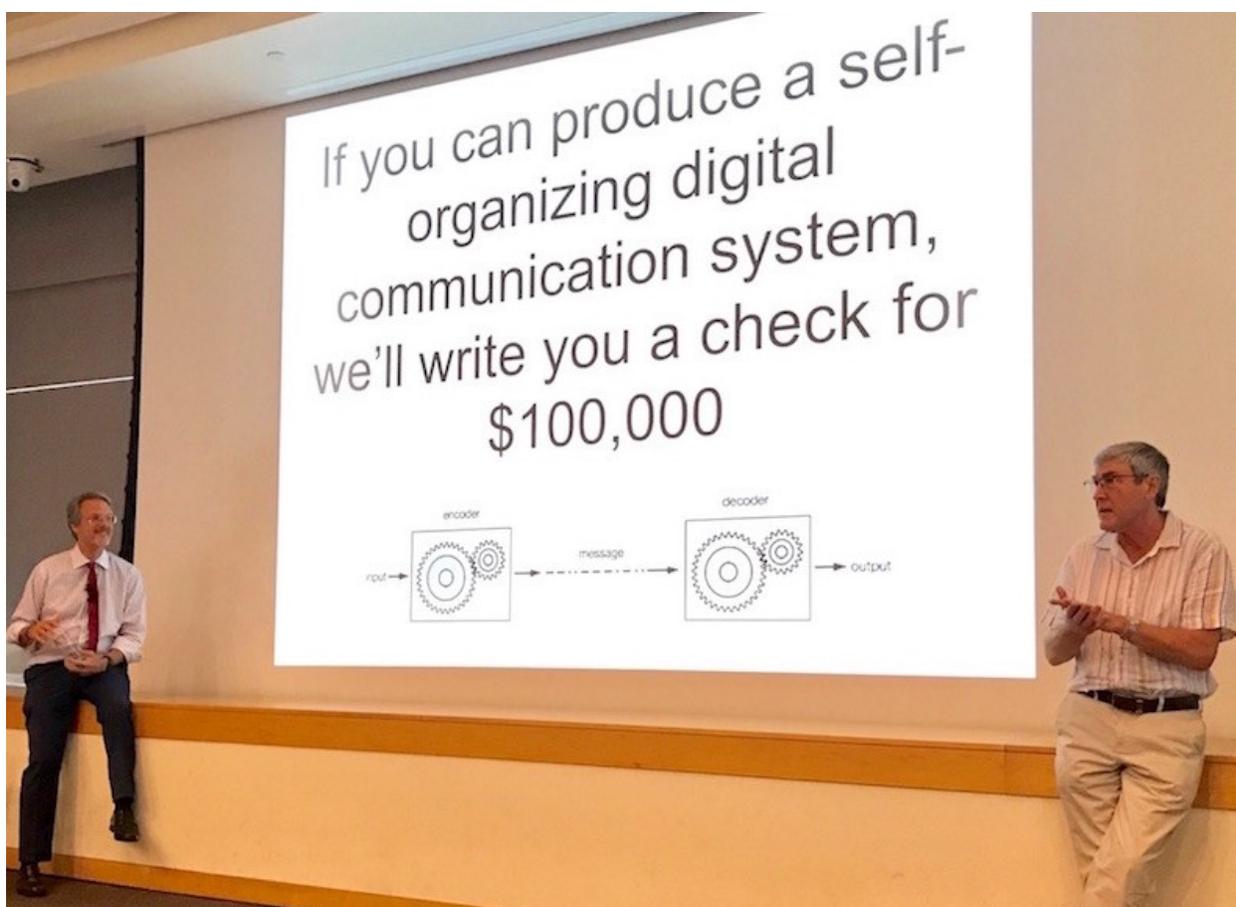


Originally published by Frontline Genomics, 1 March 2018



\$5 Million Tech Prize Seeks Answer to Origin of Life

A USD \$5 million technology prize aims to crack the origin of genetic code. The [Evolution 2.0 Prize](#) was announced at Arizona State University in August 2017. The largest “origin of life” prize to date, it seeks to bridge the gap between chemistry, genomics and modern computing.



Perry Marshall with physicist Paul Davies at the prize announcement at Arizona State University

Evolution 2.0 prize founder Perry Marshall, an electrical engineer, author and business consultant, became entranced with the parallels between DNA and computer information.

“A good scientific experiment will show how genetic code somehow emerged spontaneously over millions of years”

Several years ago, Marshall wrote a book about industrial Ethernet for the world’s largest society of process engineers. “It occurred to me that the data structure in DNA was strikingly similar to Ethernet,” says Marshall. That led to the Chicago, IL based engineer-cum-businessman, to think “if genetic code somehow emerged spontaneously over millions of years, as many people believed, then a good scientific experiment will show how.

“After much debate, I realized way to solve endless arguments about life’s origin was to put a large sum of money on the table and invite people to solve it. After all, crowdsourcing has been successful for inventions in other areas.”

Detractors think contest is unwinnable

The prize is not without its detractors. PZ Myers, a University of Minnesota biologist who believes that genetic code spontaneously emerged and evolved, has debated Marshall in public venues. “I think it’s a sham. There’s no way [Perry Marshall] is going to give the prize to anybody.” Jon Perry of *Stated Clearly*, a YouTube science channel with more than 170,000 subscribers, is similarly skeptical of the prize. “It’s specifically worded so that he will never have to pay,” he remarked on his blog.

Marshall responds: “If origin of life can be solved, then someone can

win this prize. We ought to be able to demonstrate the process. A scientific model should be reproducible.” He notes that the Miller-Urey experiment in 1953 discovered that chemicals and sparks could generate amino acids. “If an updated version of that experiment produced codes, it would absolutely qualify.”

Answer could impact genomics, medicine, agriculture, AI

Marshall states that answering the origin of life question this way “will be medically useful. An answer will impact genomics, agriculture, cancer and AI.

“Backers of this prize include a Medical Doctor, and engineer and several CEOs. They’re involved in Blockchain technology, domain names, investment banking and real estate. They are extremely interested in solving this. We believe it’s a search for an undiscovered law of physics. This could be one of the greatest science discoveries of all time.”

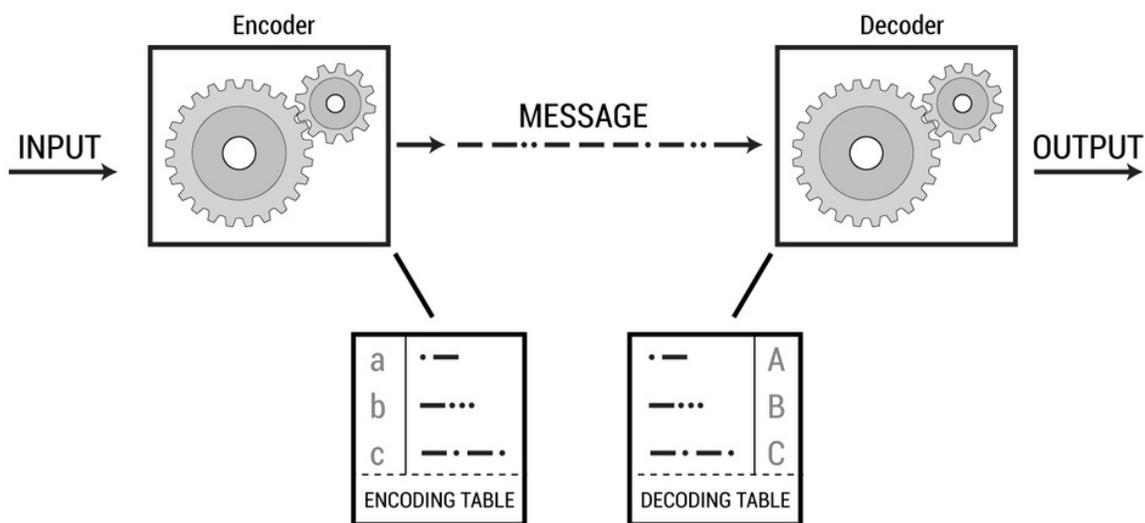
George Church, Professor at Harvard University and Director of the [Personal Genome Project](#), is a member of the judging panel for the Evolution 2.0 Prize. Church echoes Marshall’s optimism: “I would not be surprised if this particular problem is solved in the next five years, because considerable amounts of basic relevant nucleic acid chemistry has already been explored. A breakthrough of this magnitude could have a large return on investment.”

Marshall has received numerous submissions from Europe and North America, including proposals from a Canadian PhD candidate in Chemistry at Rice University and a software engineer from Austria. Several entries appear on the company’s website. “Their reasoning is impressive, but nobody has solved it yet,” he says.

A winning team must produce a physical encoder, message, and decoder that self-organize

The contest, which runs through November 2026, is hosted by HeroX, a crowdsourcing platform with hundreds of sponsors ranging from startups to NASA and Coca-Cola. HeroX is sister to the XPrize foundation founded by Peter Diamandis, who launched the famous \$10 million Ansari Prize for Space Flight.

The Evolution 2.0 Prize stipulates that a winning team must produce a physical encoder, message, and decoder that self-organize. “You can’t cheat,” Marshall notes. “Participants can’t sneak design into the equation. The code must emerge naturally given the right initial conditions.”



DNA translation and computers share three common elements: encoder, message and decoder. The Evolution 2.0 Prize seeks a naturally occurring code.

Marshall offers \$100,000 for a solution of any kind; \$5 million USD if the approach is patentable. “We seek a patent. Natural Code LLC will pay the patent fees and license the technology.” The firm plans to award the solver both the prize money and partnership in future profits of the company.

“We intend to commercialize this technology,” Marshall says. “Can Siri ‘wake up’? We hope to find out. We believe this will be very attractive to Apple, Google, and many biotech and venture capital firms.”

Physicist Paul Davies, director of the BEYOND Center at Arizona State University, proposes that rather than being a mere byproduct of life, information is central to life and its origin. Davies and physicist Sara Imari Walker compare the origin of genetic information to the famous [Hard Problem of Consciousness](#). They call the information problem ‘The Hard Problem of Life,’ saying it’s a question of how information can control chemistry, rather than the other way around.

University of Oxford Professor Denis Noble is one of three judges for the Evolution 2.0 Prize. Noble says, "The very word 'code' implies that someone or something decided what the code should be. If life arose by itself, then there must have been a natural process by which the coding could have arisen. Was that purely serendipitous? Or was it physically inevitable that the code should have arisen? Or something very like it?"

“If it was inevitable, what algorithm could achieve that? That must be one of the biggest challenges there could be in science.”

Evolution is more than random mutation and selection

Noble developed the first computer model of a human organ in 1960, which was the heart. His research made pacemakers possible and led to the development of the drug Ivabradine. A long-time critic of conventional evolutionary theory, Noble authored the paper “Physiology is rocking the foundations of evolutionary biology.”

Two books and a famous keynote he delivered to the International Congress of Physiology challenge the standard Neo-Darwinian synthesis. As a Fellow at Britain’s Royal Society, Noble organized a 2016 conference there which explored an Extended Evolutionary

Synthesis, proposing there's more to evolution than just random mutation and selection.

In his paper ["Was the Watchmaker Blind? Or Was She One-Eyed?"](#) published December 2017 in the refereed journal *Biology*, Noble writes, "Evolution may have no foresight, but it is at least partially directed by organisms themselves and by the populations of which they form part."

Efforts to exchange insights between biology and computer science are not new. A recent [article in *Frontline Genomics*](#) details how machine learning tasks require orders of magnitude more computing power than the human brain. 'Neuromorphic' hardware created by the National Institute of Standards and Technology mimics neuron behavior.

George Church leads [Synthetic Biology at Harvard's Wyss Institute](#), where he oversees directed evolution of molecules, polymers, and whole genomes, and is a leader in the development of CRISPR. Church says, "It seems plausible that cell biological computers [brains] are already more versatile and have lower power consumption. Also, biotechnology is improving exponentially five-fold faster than electronic [Moore's law]. Synthetic biology might be a shortcut to getting AI to use atomic precision inexpensively and at large scale.

"There are several problems in which computing of complex quantum systems (like protein folding and function) can be accomplished a billion-fold faster by synthesizing proteins, than by using modern silicon/electronics-based computing for simulations."

Perry Marshall suspects that the origin of code and the natural genetic engineering of cells share common physical causes. "Bacteria re-arrange their DNA to fight antibiotics in minutes. Cell AI is 1000X superior to anything from Silicon Valley. We need to discover what makes this possible."

“If Microsoft knew what bacteria know, their stock price would spike 10X”

He says, “Windows can’t evolve without programmers. But bacteria evolve by themselves in minutes. What do bacteria know that we don’t? If Microsoft knew what bacteria know, their stock price would spike 10X.”

Michael Ruse, a Professor of History and Philosophy of Science at Florida State University, is the third member of the judging panel for the Evolution 2.0 Prize. Ruse says, “I regard this as one of the most fascinating and yet ultimately soluble scientific problems that we have, and I would love to know the answer. I am bit dubious about information theory, and that is why I am involved. I will do my best to knock down anything that comes up, and no one will be more delighted than I if I fail. It's a win-win situation.”

To learn more about the Evolution 2.0 Prize, visit <https://www.herox.com/evolution2.0>

Materials provided by Natural Code LLC

Originally published by Frontline Genomics, 1 March 2018