

Evolutionary Biology Pioneer Lynn Margulis Dies

By Kieran Mulvaney | Thu Nov 24, 2011 01:31 PM ET



Death has not always been a part of life; for perhaps the first billion years in which life existed on Earth, death was an aberration, a function of adverse environmental conditions -- a pool of water being too hot, or too cold - - rather than an inevitability. Death as a way of life is, it appears, [a consequence of the development of sex](#).

[SCIENCE CHANNEL: 10 Predictions for Evolution Over the Next Million Years](#)

But how did sex begin? And why? In the words of evolutionary biologist Lynn Margulis, the answer was a by-product of cannibalism. [Writing in *Scientific American* in 1994](#), she argued that:

Sex began when unfavorable seasonal changes in the environment caused our [protocist](#) predecessors to engage in attempts at cannibalism that were only partially successful. The result was a monster bearing the cells and genes of at least two individuals (as does the fertilized egg today) ... Those microbial ancestors that fused survived, whereas those that evaded sexual liaisons died.

The following year, in a chapter for a book entitled [The Third Culture: Beyond the Scientific Revolution](#), by

John Brockman, she wrote, by way of expansion and elucidation:

It may have started when one sort of squirming bacterium invaded another — seeking food, of course. But certain invasions evolved into truces; associations once ferocious became benign. When swimming bacterial would-be invaders took up residence inside their sluggish hosts, this joining of forces created a new whole that was, in effect, far greater than the sum of its parts: faster swimmers capable of moving large numbers of genes evolved. Some of these newcomers were uniquely competent in the evolutionary struggle. Further bacterial associations were added on, as the modern cell evolved.

In other words, Margulis proposed, so-called eukaryotes -- cells with nuclei, [of which all multi-cellular organisms, including humans, are comprised](#) -- are the result of the symbiotic fusion, eons ago, of different prokaryotic lifeforms.

NEWS: Meet LUCA: Our Complex Ancestor

The result of this joining of forces is inside each and every one of us, in the form of the cells that combine to create our skin, our hair, our eyes, our blood. Perhaps the strongest evidence that this is so, she wrote in the above-excerpted chapter, is the existence within most eukaryote cells of [mitochondria](#), which have their own DNA:

In addition to the nuclear DNA, which is the human genome, each of us also has mitochondrial DNA. Our mitochondria, a completely different lineage, are inherited only from our mothers. None of our mitochondrial DNA comes from our fathers. Thus, in every fungus, animal, or plant (and in most protocists), at least two distinct genealogies exist side by side. That, in itself, is a clue that at some point these organelles were distinct microorganisms that joined forces.

By the time she wrote the above, her theory had become accepted as orthodoxy. When first she proposed it, it was anything but. Her initial 1966 paper was rejected by about 15 different publications, as she recalled, before being picked up by the *Journal of Theoretical Biology*; despite having a publishing contract, when she expanded that paper into a book, her initial publisher rejected the manuscript.

PHOTOS: Evolution Controversies: A History in Photos

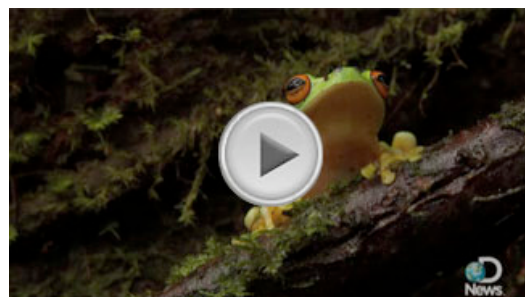
It was eventually published in 1970 as [The Origin of Eukaryotic Cells](#), by Yale University Press. In a response to her chapter in Brockman's book, [Richard Dawkins](#) wrote of, not only her theory, but her tenacity in its advocacy: "This is one of the great achievements of twentieth-century evolutionary biology, and I greatly admire her for it."

Perhaps because she saw evolution as a symbiotic, rather than purely 'selfish', process, Margulis was also drawn to the [Gaia hypothesis](#) that, around the time she was pushing her own maverick theory, was being developed by [James Lovelock](#).

Gaia, explains John Horgan, essentially postulates that Earth's biota [chemically regulates its environment in such a way as to promote its own survival](#); but although Margulis came to be associated with the hypothesis almost as closely as Lovelock, she resisted some of the more 'spiritual' vocabulary he used to describe it. She rejected, for example, his portrayal as Earth as a living organism, preferring instead the notion that it is one big ecosystem comprised of many smaller ones.

Born in Chicago in 1938, Margulis [enrolled at the University of Chicago when she was just 14](#). At 19, she married the astronomer [Carl Sagan](#), and one's brain bows down on metaphorical bended knee at the thought of some of the intellectual conversations that must have taken place at the breakfast table during that marriage.

She was elected to the National Academy of Sciences in 1983 and received the National Medal of Science in 1999. She died on Nov. 22, age 73, succumbing to the fate that will eventually meet us all, the inevitable conclusion of a train of events that, as she identified, was set in motion billions of years ago, when one cell invaded another.



VIDEO: More Than 200 New Species Found

Photo: Lynn Margulis at work in a greenhouse, circa 1990. (Nancy R. Schiff/Getty Images)

SIGN UP FOR **DISCOVERY NEWS DAILY**

Email:
