An answer to another of life's big questions

February 5 2010

(PhysOrg.com) -- Monash University biochemists have found a critical piece in the evolutionary puzzle that explains how life on Earth evolved millions of centuries ago.

The team, from the School of Biomedical Sciences, has described the process by which bacteria developed into more complex cells and found this crucial step happened much earlier in the evolutionary timeline than previously thought.

Team leader and ARC Federation Fellow Trevor Lithgow said the research explained how mitochondria - the power house of human and other cells, which provide complex eukaryotic cells with energy and ability to produce, divide and move - were thought to have evolved about 2000 million years ago from primitive bacteria.

"We have now come to understand the processes that drove cell evolution. For some time now the crux of this problem has been to understand how eukaryotes first came to be. The critical step was to transform small bacteria, passengers that rode within the earliest ancestors of these cells, into mitochondria, thereby beginning the evolution of more complex life-forms," Professor Lithgow said.

The team found that the cellular machinery needed to create mitochondria was constructed from parts pre-existing in the bacterium. These parts did other jobs for the bacterium, and were cobbled together by evolution to do something new and more exciting.

"Our research has crystallised with work from other researchers around the world to show how this transformation happened very early on - that the eukaryotes were spawned by integrating the bacterium as a part of themselves. This process jump-started the evolution of complex life much more rapidly than was previously thought."

The research consisted of two components, the first used computers to read, compare
and understand DNA sequences. From this, experiments were designed to do actual laboratory testing using a bacterium that is the closest living relative to the original ancestor of the mitochondria.

The research was published in the prestigious journal *Science* today.

Professor Lithgow said the latest findings were only made possible due to a gradual gathering of evidence within the scientific community and recent developments in genome sequencing. "We can now "read" with great care and insight genome sequences - the complete DNA sequence of any organism. From these sequences we find tell-tale clues to the past. Our findings are relevant to all species, including the evolution of humans," Professor Lithgow said.

"It continues to amaze that this theory, proposed in the century before the advent of molecular investigations, is so accurate on a molecular scale. This improved understanding is directly relevant to the big picture timeline for the evolution of life."

Professor Lithgow said the findings will be regarded by some scientists as controversial as many have long-held views on the process of evolution as a tinkerer. "This will surprise and may even spark debate. However our research compliments the basic rules of life. Even at the molecular level, the rules of the game are the same. Evolution drives biology to more and more complex forms," Professor Lithgow said.

Provided by Monash University

Citation: An answer to another of life's big questions (2010, February 5) retrieved 25 April 2024 from https://phys.org/news/2010-02-life-big.html

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