

Life secret exposed: Scientists unlock mystery of molecular machine

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A major mystery about the origins of life has been resolved. According to a study published in the journal *Nature*, two Université de Montréal scientists have proposed a new theory for how a universal molecular machine, the ribosome, managed to self-assemble as a critical step in the genesis of all life on Earth.

"While the ribosome is a complex structure it features a clear hierarchy that emerged based on basic chemical principles," says Sergey Steinberg, a Université de Montréal biochemistry professor who made his discovery with student Konstantin Bokov. "In the absence of such explanations, some people could imagine unseen forces at work when such complex structures emerge in nature."

What is a ribosome?

The ribosome is an enormous molecule responsible for translating the messages carried in the genetic code of all organisms into the workhorse molecules of the cell - proteins - that carry out all functions, including replicating the genome itself. As the world celebrates the bicentennial anniversary of the Father of Evolution, Charles Darwin, Prof. Steinberg's theory brings the scientific community even deeper into the study of the origins of life.

By examining the molecular self-organizing processes that preceded the living cell, the point where time begins for biologists, Prof. Steinberg

goes further than Darwin and the many evolutionary biologists who followed could have imagined

By the standards of biological molecules, ribosomes are immense. Though visible only through lenses of the most powerful microscopes, comparing most other biological molecules to this behemoth is like comparing a tricycle to a jumbo jet. Having spent years gazing at the detailed structure of the ribosome, Prof. Steinberg pondered how such an immense and complex structure could have assembled itself from smaller building blocks that existed on the early Earth.

From the simple to the complex

The key breakthrough came when he realized that the ribosome is organized by a set of simple structural rules and that it had to be assembled from basic building blocks in a very specific order; otherwise it would have fallen apart. He then showed with mathematical rigor that the construction of the ribosome likely followed an ordered series of steps to form the structure found in the first living cell. To this day, that structure exists almost unchanged in our own cells.

Chemists have been able to observe many examples of self-organizing behavior with simple molecules, yet explaining the complex self-assembly of biomolecules had not been so obvious.

"Thanks to the research of Sergey Steinberg and Konstantin Bokov, scientists now have a glimpse of one key event that emerged spontaneously out of the primordial chemical soup of the early Earth," explains Stephen Michnick, a Université de Montréal biochemistry professor and Canada Research Chair in Integrative Genomics. "Perhaps in the near future we may look forward to more discoveries that will take us beyond the world of Darwin into an understanding of the basic chemical principles that drove the emergence of life on our planet and

perhaps beyond."

Source: University of Montreal

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