Study Reveals Unexpected Ancient Cellular Structure

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(PhysOrg.com) -- Scientists at North Carolina State University have effectively lifted the veil from the structure of an ancient and important RNA-protein complex essential for the biosynthesis and function of the ribosome, the protein-manufacturing machine of all cells. This RNA-protein enzyme performs a critical task in modifying the nucleotides of ribosomal RNA, modifications that are essential for protein synthesis.

A study published in the Sept. 11 edition of the journal *Science* reveals a surprising two-part, or dimeric, structure for the so-called box C/D small ribonucleoprotein (RNP) complex in Archaea, the kingdom of tiny, single-celled organisms without nuclei. The complex comprises a single RNA component bound with multiple bound proteins. Conventional theory suggested that the structure of this RNP was smaller and monomeric.

Understanding more about the architecture of this RNP complex in Archaea is important, says Dr. E. Stuart Maxwell, professor of molecular and structural biochemistry at NC State and a co-author of the paper describing the research, because Archaea can serve as a model system for the study of RNPs in larger and more complex eukaryotic organisms. Knowing more about this RNP structure should provide scientists with clues as to how the eukaryotic ribosome is synthesized and functions.

“For the first time, we’ve been able to provide some insight into the organization of this essential RNP complex,” Maxwell says. “An important implication is that this RNP complex appears to undergo large

conformational changes, as some of the proteins make large back-and-forth movements to accomplish their task in nucleotide modification."

Maxwell adds that this ancient RNP complex has existed for more than 2 billion years, arising before the kingdoms of Archaea and Eukarya diverged. Eukaryotic cells, which include a nucleus, have maintained this RNP for its essential role in ribosome biosynthesis and function. The strong conservation of this ancient RNA-protein enzyme highlights its importance, Maxwell adds.

In addition to NC State post-doctoral researcher Keith T. Gagnon, scientists from Yale University - including senior investigator Dr. Susan Baserga - and Harvard University co-authored the paper.

More information: "A Dimeric Structure for Archaeal Box C/D Small Ribonucleoproteins" Authors: Keith T. Gagnon, Bernard Brown, and E. Stuart Maxwell, North Carolina State University; Franziska Bleichert, Vinzenz M. Unger and Susan J. Baserga, Yale University; Andres E. Leschziner, Harvard University; Published: Sept. 11, 2009, in *Science*.

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