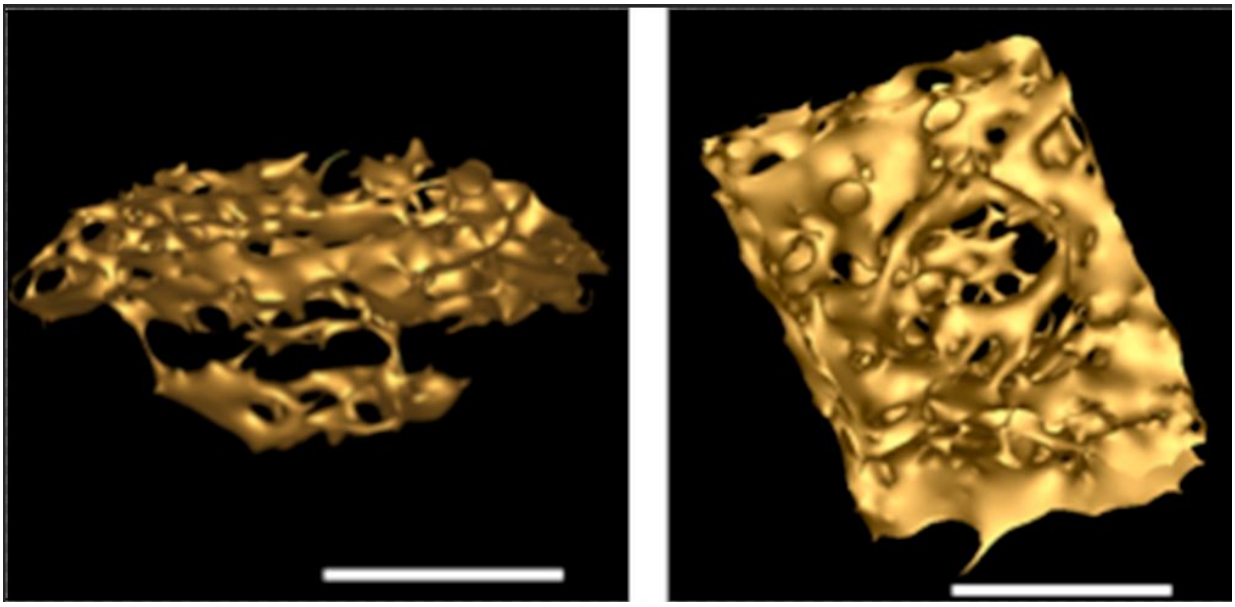
Complex bacterium writes new evolutionary story

February 1 2017



Tomography images of pores in the bacterium seen from the side and from the top. Credit: Professor John Fuerst

A University of Queensland-led international study has discovered a new type of bacterial structure which has previously only been seen in more complex cells.

Research team leader UQ School of Chemistry and Molecular Biosciences microbiologist Emeritus Professor John Fuerst said the study had found pore-like structures in a bacterium called *Gemmata*

obscuriglobus.

"The pore-like structures appeared embedded into the bacteria's internal membranes, and showed some structural features similar to those in more complex organisms," he said.

"This is a remarkable evolutionary finding, since most bacteria do not possess these structures.

"Finding nuclear pore-like structures in the bacterial species *Gemmata obscuriglobus* is significant for understanding how the cell nucleus and the pores embedded in its membrane envelope could have evolved - a major unsolved problem in evolutionary cell biology."

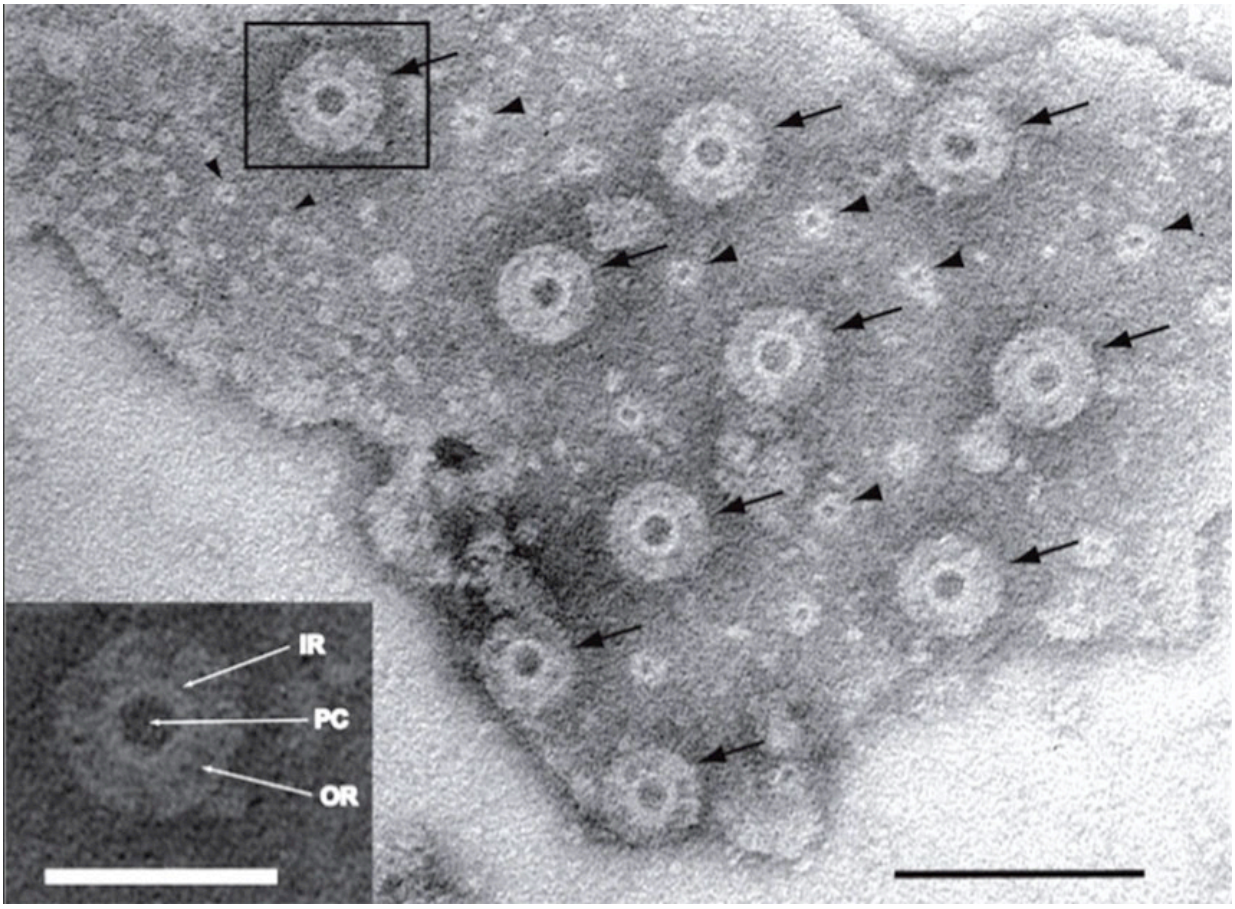
Professor Fuerst said the bacterium, which was first isolated from Maroon Dam in South-East Queensland in 1984 by UQ researchers Dr Peter Franzmann and Professor Vic Skerman, now constituted one of the most complex bacteria known.

He said the finding suggested that the evolution of complex cell structures may not be unique to eukaryotes, which are organisms containing a nucleus and other structures (organelles) encased in a membrane.

"The research finding is consistent with previous data my lab has published indicating that the *Gemmata obscuriglobus* bacterium contains a nuclear body compartment, which parallels the eukaryote nucleus."

Professor Fuerst said the discovery was important for understanding how the first complex cells may have originated.

"The results are of evolutionary significance, since the origin of eukaryotes is a major event in life's history," he said.



Pore-like structures of the bacterium *Gemmata obscuriglobus* scattered over membrane released from lysed cells (transmission electron microscopy of a negatively stained preparation. The large type of pore-like structure has inner and outer concentric rings around a central plug, resembling the detailed organization of a eukaryote nuclear pore. Credit: Sagulenko et al (2017)

Professor Fuerst said nuclear pore complexes (NPCs) were important in transporting molecules between the nucleus containing the DNA and the rest of the cell contents in eukaryote organisms such as protozoa, fungi, animals and plants.

"They are dotted over the surface of the membranes separating the nucleus from the rest of the cell and enable communication between the nucleus and other parts of the cell," he said.

"Like the membrane-bounded nucleus, NPC's had been thought to be restricted to eukaryotes."

The researchers used a combination of techniques including advanced electron microscopy, a protein analysis method called proteomics, and bioinformatics genome analysis to make the discovery.

The study is published in *PLOS ONE*.

More information: Sagulenko E, Nouwens A, Webb RI, Green K, Yee B, Morgan G, et al. (2017) Nuclear Pore-Like Structures in a Compartmentalized Bacterium. *PLoS ONE* 12(2): e0169432. dx.plos.org/10.1371/journal.pone.0169432

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