

**Odinarchaeote-Tengchong illuminates the origination of eukaryotic endosomal system**

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Recent studies supported that eukaryotes originated in the archaeal Asgard superphylum, which is characterized by enriched eukaryotic-specific proteins. By far, few genomes of Asgard are available to firmly establish the exact phylogenetic positions of new Asgard archaeal lineages. In this study, we performed a large-scale analysis of unclassified archaeal genomes from public databases and identified a new family-level Asgard member named Odinarchaeote-Tengchong, which encodes all conserved components of endosomal sorting complexes required for transport (ESCRT), a feature distinguishable from all other prokaryotes. This finding sheds light on the origination of eukaryotic endosomal system and functional evolution of ESCRT-mediated protein degradation. ESCRT-mediated protein degradation in Odinarchaeote-Tengchong may reflect its adaption towards high-temperature environments. Metabolic analysis indicates a mixotrophic lifestyle of Odinarchaeote-Tengchong, with nearly complete glycolysis pathway for degradation of carbohydrates and tetrahydromethanopterin Wood-Ljungdahl pathway for reduction of CO<sub>2</sub>. The discovery of a new Asgard archaeal group possessing the complete and conserved ESCRT machinery may illuminate the origination of eukaryotic endosomal system in a geothermal environment dominated by prokaryotes.