

Gods of the Archaeal-to-Eukaryotic Transition

PhD opportunities at Okayama University, supervisor Professor Bob Robinson

The origin of the eukaryotic cell is controversial. Metagenomics sequencing has revealed that Asgard archaea genomes contain potential homologs to eukaryotic genes^{1,2}. The Asgard superphylum of organisms includes Heimdahl, Loki, Odin, Thor archaeota named after the Gods from Norse mythology. Several of these gene products are involved in forming the cytoskeleton, a hallmark of eukaryotic cells. Previously, we have shown that Asgard archaea contain a profilin-regulated actin system at the protein level³. Here, we will structurally characterize the Asgard eukaryotic-like protein homologs, using X-ray crystallography and cryo-electron microscopy. We use biochemical and biophysical assays and mass spectrometry to compare the activities, and cross-activities, of Asgard and eukaryotic proteins. Together, these data will reveal the relationships between the archaeal and eukaryotic protein systems, and determine whether the core interactions of these systems have been maintained during evolution. Thus, these PhD projects will produce experimental data to address the origins of the cytoskeleton and the eukaryotic cell.

The admission dates are in April and October. PhD application fees and course fees apply, however mechanisms to cover these costs can be discussed with the supervisor. Applicants should hold a MSc degree at the time of course commencement. We are looking for self-motivated, curious scientists with a sense of fun. Interested applicants should contact Bob at bobactin@gmail.com.

- 1 Spang, A. *et al.* Complex archaea that bridge the gap between prokaryotes and eukaryotes. *Nature* **521**, 173-179, doi:10.1038/nature14447 (2015).
- 2 Zaremba-Niedzwiedzka, K. *et al.* Asgard archaea illuminate the origin of eukaryotic cellular complexity. *Nature* **541**, 353-358, doi:10.1038/nature21031 (2017).
- 3 Akil, C. & Robinson, R. C. Genomes of Asgard archaea encode profilins that regulate actin. *Nature* **562**, 439-443, doi:10.1038/s41586-018-0548-6 (2018).