**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI**
**SHORT ABSTRACT OF THESIS**


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## SHORT ABSTRACT


The process of protein translation involves decoding of a nucleic acid into a polypeptide chain in three steps viz. initiation, elongation and termination. Although the basic mechanism and components of protein translation are highly conserved, the translation initiation stage has undergone extensive divergence in bacteria and eukaryotes. The most distinct difference lies in the number of accessory proteins called translation initiation factors (IFs). Bacteria utilize only three translation IFs while eukaryotes employ about a dozen of them during protein translation initiation. In case of archaea, which is a prokaryote, an unexpectedly large set of translation IFs are reported.

The presence of functional homologs of eukaryotic translation IFs, eIF1 and eIF2B in archaea remains unclear and there is a lack of experimental evidences describing the (non)availability of a functional aIF1 and aIF2B in archaea. Thus, we aimed to investigate the presence of aIF1 and aIF2B in a hyperthermophilic archaeon, *Pyrococcus horikoshii* OT3 which would further enhance our understanding of protein biosynthesis mechanism in archaea. The open reading frames (ORFs) encoding the homologs of eukaryotic translation IFs, eIF1 and eIF2B have been identified in *P. horikoshii* OT3. However, these ORFs also shows similarity with functionally unrelated proteins involved in various metabolic processes. To substantiate the function of the identified proteins, their three-dimensional crystal structure has been elucidated. Detailed structural analysis of the proteins demonstrates that even though archaea possess the homolog of eIF1, they lack the functional homolog of eIF2B. Instead of functioning as homologs of the different subunits of eIF2B, the identified ORFs function as enzymes such as ribose-1,5-bisphosphate isomerase (R15Pi), 5-methylthioribose 1-phosphate isomerase (M1Pi), NDP-sugar pyrophosphorylases (NSPases). This raises a concern for the long-held notion that the process of archaeal and eukaryal translation initiation is homologous. Thus, there is a demand for the re-evaluation of the mechanism of archaeal protein translation initiation which might be closer to bacteria or an exclusive mechanism of translation initiation might be persisting in archaea.