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Diversity Functions of Puf Proteins in Protozoan Species

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Editorial

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Editorial

In all eukaryotic cells, the regulation of gene expression is accomplished at both transcriptional and translational levels. At the translational level, control of gene expression is often mediated by cis-acting elements in the 3' untranslated region (UTR) of the mRNA. This regulation is achieved through a network of RNA binding proteins (RBPs) that have great effect on stability, localization and translatability of their target mRNA. The Puf family RBPs named after Pumilio (Pum) protein in Drosophila melanogaster and fem-3 binding factor (FBF) protein in Caenorhabditis elegans [1,2], represent a highly conserved group of RBPs found in many organisms including animals, plants, fungi and protists [3-5].

So far, only a few Puf protein members have been identified in protozoan species. Two Puf RBPs (PfPuf1 and PfPuf2) of P. falciparum have been identified in 2002 [6]. PfPuf1 has a central Puf domain, whereas PfPuf2 has C-terminal Puf domain. Both of them are preferentially expressed in the gametocyte stages [6,7]. Disruption of PfPuf1 showed no noticeable phenotypic changes in the asexual stage of the parasites, but in the sexual stage, gametocytes showed growth defect after stage III [8]. Interestingly, whereas most Puf binding elements (PBEs) are localized in the 3′ UTR or 3′ UTR proximal coding region of target mRNAs, PfPuf2 has been found to repress Pfs25 by binding to the PBE in the 5′ UTR of pfs25 to mediate translation repression, suggesting that Puf proteins are versatile translation regulators [9,10].

Most recently, another Puf protein, PfPuf3 has been characterized in P. falciparum. This protein is a nucleolar protein which participated in ribosomal biogenesis in malaria parasites [11]. In the rodent malaria parasite P. berghei, targeted deletion of Puf2 did not have any effect on asexual stages [12]. However, PbPuf2 knockout sporozoites showed apparent morphological changes and defects in motility, cell traversal and infection when compared with wild type parasites [13]. In contrast to PbPuf2 knockout parasites, Puf2 knockout sporozoites in P. yoelii did not show apparent defect in host infection at first, but progressively become non-infectious [14]. In Toxoplasma gondii, only two Puf RBPS (TgPuf1 and TgPuf2) have been found and TgPuf1 protein exhibits different expression levels in bradyzoites and tachyzoites. RNA Electrophoretic Mobility Shift Assay (EMSA) showed that TgPuf1 has conserved RNA binding activity and specificity, suggesting that TgPuf1 may regulate mRNA translation during transition from bradyzoites to tachyzoites [15]. The first nucleolar Puf identified in 25 protozoan species is T. brucei Puf7. Deletion of TbPuf7 inhibited ribosomal RNA processing, resulting in retarded parasite growth [16]. All these data demonstrated that Puf RBPs in protozoan species have important functions.

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