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Molecular characterization of calreticulin: A biomarker for temperature stress responses of the giant tiger shrimp *Penaeus monodon*

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In crustaceans, calcium signaling plays important roles in growth, reproduction and molting. Calreticulin (CRT) is a main protein involved in calcium homeostasis of eukaryotes. The full-length cDNA of CRT in the giant tiger shrimp (*Penaeus monodon*), identified by RACE-PCR, was 1682 bp in length, containing an ORF of 1221 bp corresponding to a deduced protein of 406 amino acids. Genomic sequence of PmCRT spanned 3006 bp, composing of 4 exons (85, 119, 187 and 830 bp) and 3 introns (411, 231 and 120 bp). Semi-quantitative RTPCR revealed that PmCRT in hemocytes of juvenile *P. monodon* was up-regulated at 0 and 1 h post treatment (hpt) at 35°C for 3 h (Pb0.05). However, expression levels of PmCRT in gills and hepatopancreas after the

temperature stress (0-48 hpt) were not significantly different (n=3 for each group; PN0.05). Quantitative real-time PCR confirmed the expression profile of PmCRT in hemocytes and illustrated that this transcript was up-regulated at 0 and 3 hpt for approximately 25 folds (n=5; Pb0.05), reduced to about 5 folds between 3 and 12 hpt (Pb0.05) and returned to the baseline level at 24 and 48 hpt (PN0.05). Recombinant PmCRT was successfully expressed *in vitro* and exhibited an ability to form a complex with recombinant endoplasmic reticulum protein 57 of *P. monodon* (rPmERp57). Results from this study strongly suggested that PmCRT can be regarded as a biomarker for temperature stress responses in *P. monodon*.

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