Regulation of ferritin and globin genes in cold-water sea sponges Halisarca dujardini and Halichondria panicea and its role during reaggregation

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Sponges (Porifera) are the oldest multicellular organisms with the unique ability to restore the functional organization of the body after mechanical dissociation in the form of multicellular aggregates. The cold-water sponges of the White Sea Halisarca dujardini (H.d.) and Halichondria panicea (H.p.) (cl. Demospongia) are extremely resistant to daily and seasonal changes in water temperature, salinity and oxygenation. We studied sponge ferritins — the main iron-storage proteins, and globins — heme-containing oxygen transporters, along with their contribution to cellular plasticity during the reaggregation experiment. In the transcriptomes of H.d. and H.p. (previously published in: Finoshin AD, Adameyko KI, et al. (2020) PLoS ONE 15(2): e0228722) and in the draft genome of H.d. we identified genes of interest and confirmed their amino acid sequences by mass spectrometry. Three ferritin genes were identified in H.d. and one in H.p. A TATA box, Inr and DPE promoter elements were found in H.d. ferritin genes. The 5'UTRs of H.d. and H.p. ferritin mRNAs contain iron-responsive elements (IREs). In both sponge species, we identified two globin genes: androglobin and neuroglobin. Expression of neuroglobin of H.d. unlike human Ngb is regulated by a TATA-containing and not CG-rich promoter (previously published in: Adameyko KI et al. (2020) Mol Biol 54, 416–420). RNA-Seq samples of H.d. collected at different life cycle stages and subjected to the reaggregation experiment revealed differential expression: in the samples collected at the end of body growth (autumn) and the beginning of spermatogenesis (winter) expression of ferritin and neuroglobin decreased during dissociation and then restored during reaggregation; in the samples collected at the beginning of body growth (summer) expression of both genes decreased during both stages. Our results suggest the evolutionary importance of globins and ferritin genes in the morphogenetic processes of multicellular animals.

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