Tunicate Neurogenesis: The Case of the SoxB2 Missing CNE

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Abstract The discovery of the SoxB2/Sox21 regulatory element, conserved from basal metazoan to human, opened novel perspectives to study the conservation among distant related genomes. This discovery represents exceptional maintenance of an almost identical enhancer structure controlling a gene that is fundamental for nervous system development. The activity of metazoan SoxB2 enhancers was previously demonstrated in zebrafish embryos by cross-species experiments.

Here we tested the activity of human and amphioxus orthologue cis-regulatory sequences in embryos of the tunicate Ciona intestinalis through a transgenic approach, and found out that SoxB2 enhancers retained their activity in neuronal differentiation even in a non-vertebrate chordate.

This result was unexpected since the conserved SoxB2 enhancer was not found in Ciona in previous studies. Nevertheless, we adopted a different comparative approach and performed a phylogenetic footprinting analysis using two congeneric tunicate species, C. intestinalis and Ciona savignyi, that, in fact, evidenced a conserved SoxB2 3’ element. The discovered element could potentially be the missing orthologous SoxB2 enhancer previously identified in human, zebrafish, and amphioxus.

A detailed search for possible transcription factors revealed the massive presence of Sox, Pou and Fox binding sites as found in other deuterostomes. Nevertheless, whether the conserved SoxB2 element of Ciona possesses a functional ability as gene transcriptional enhancer remains to be demonstrated experimentally.

Keywords Evolution • Transgenesis • Nervous system • Ciona • Cis-regulatory enhancers