

Musashi Protein in Craniofacial Development in Zebrafish

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Problem: Neural crest (NC) cells are a multipotent, stem cell-like population derived from the ectoderm. After delaminating, they continue to differentiate and develop into a wide variety of derivatives. In particular, the cartilage of the jaw and brachial arches are derived from the NC cells. Understanding the multipotent nature of NC cells – as well as their gradual loss of this property – is an area of active research. The RNA-binding protein Musashi has been established as a marker for neuronal stem cell and a member of this family is specifically expressed in the craniofacial region of zebrafish embryos early in development.

Hypothesis: The Musashi protein plays an important role in the craniofacial development of zebrafish.

Methods: In situ hybridization and antibody staining were performed to assess Musashi expression. In addition, we used morpholino knockdown to interfere with protein expression. Splice or control morpholinos were injected at the one cell stage, and embryos were fixed at various stages and analyzed for developmental markers.

Results: Using a Sox10-GFP transgenic line, we have determined that morpholino knockdown of Musashi affected NC cells as early as 24 hpf ($p < 0.000$), with a effect specifically on the development of the brachial arches ($n = 245$, $p < 0.000$). Alcian Blue staining confirmed later inhibition of chondrogenesis in the lower jaw ($p < 0.000$).

Conclusion: Musashi protein is necessary for normal development of the jaw in zebrafish, namely affecting protrusion of the lower jaw and development of brachial arches.