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Role of Gbx2 expression in cranial nerve V development

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Gbx2 is a member of the Gbx family of homeobox genes that encodes for the transcriptional factors Gbx1 and Gbx2. The amino acid sequence of Gbx2 is highly conserved across multiple species (e.g. mice, zebrafish, chicken, and frogs) with nearly 100% sequence identity between the Gbx2 homeodomains of the aforementioned species. Expression studies have shown that Gbx2 is expressed early during gastrulation in the posterior neural plate (Bouillet et al., 1995) and prospective anterior hindbrain (Niss and Leutz, 1998). The function of Gbx2 in mice and zebrafish has been extensively studied with loss-of-function as well as hypomorphic models in both species. Results of these studies have shown that the Gbx2 homeobox gene is required for normal development of the isthmic organizer at the midbrain hindbrain boundary (MHB) that is responsible for patterning the midbrain and the anterior hindbrain. The hindbrain controls many basic life functions such as breathing and heartbeat. In early vertebrate development, the hindbrain is partitioned into seven or eight distinct segments called rhombomeres (r). Rhombomeres give rise to differentiated brain regions such as the cerebellum, pons, and medulla oblongata. Previous studies had shown that cranial nerve V (nV), derived from r2 and r3, fails to develop normally in Gbx2 hypomorphic mice. The nV motor axons innervate several muscles, including those in the jaw required to suckle and masticate. These Gbx2 hypomorphic mice die immediately after birth presumably due to an inability to nurse on their mother as wild-type mice do. Our preliminary studies have shown that zebrafish Gbx2 also affects nV development. Our research this summer was focused around examining if mouse Gbx2 can rescue the abnormalities in nV caused by injecting morpholino. To accomplish this, we will attempt to rescue the hindbrain phenotype in zebrafish embryos by simultaneously injecting zebrafish morpholino with synthesized mouse Gbx2 mRNA.