The immediate-early genes serve as useful neurobiological tools for mapping brain activity induced by sensory stimulations. In this study, we have examined brain activity related to gravity perception of medaka (Oryzias latipes) by use of c-fos. The gene, which is homologous to the c-fos genes of other vertebrates, was identified in medaka. Functionally important domains are highly conserved among all the vertebrate species analyzed. Intraperitoneal administration of kainic acid transiently induced the c-fos mRNAs in medaka brain. The results indicate that the expression of c-fos can be utilized as a suitable anatomical marker for the increased neural activities in the central nervous system of medaka.

Fish were continuously exposed to 3G hypergravity by centrifugation. Investigation of c-fos mRNA levels showed that c-fos mRNA significantly increased 30 minutes after a start of 3G exposure. The distribution of its transcripts within brains was analyzed by an in situ hybridization method. The 3G-treated medaka fish displayed c-fos positive cells in their brainstem regions, specifically in inferior olive, torus semicircularis, posterior octavus nucleus, and nucleus tangentialis.

Fish exhibit looping and rolling behaviors when subjected to short periods of microgravity during parabolic flight. Strain-differences in the behavioral response of adult medaka fish have been reported, however, there are few studies for the behavioral response of larval fish under microgravity. We investigated whether microgravity affects the swimming behavior of larvae at various ages (0 to 20 days after hatching), using different strains: HNI-II, HO5, ha strain and variety. Some of them exhibited looping or rolling behaviors, and others appeared to maintain their orientation, swimming with their backs turning toward the light source (dorsal light response, DLR).

Fry of ha strain lacking utricular otoliths are highly light-dependent at the time of hatching, showing a perfect DLR. As they grow, they eventually shift from being light dependent to gravity dependent. Continuous treatment of fry with altered light direction suppressed this shift to gravity dependence. Being less dependent on gravity, these fish can serve as model fish in studying the differences expected for the fish that have experienced a life cycle in microgravity.

Formation and development of otoliths were studied for ha and wild-type fish. Observation covered the entire stage of otoliths development ranging from their initial appearance in otic vesicles of embryos to those in adult fish. A delay of few developmental stages was noted for formation of saccular otoliths in ha embryos when compared with that in wild-type embryos. However, there were no differences in the appearance of lagenar otoliths. In both strains there exists a clear relationship between the fish body length and emergence of the lagenar otoliths. When fish grow 9 mm or longer, the lagenar otoliths appear.
Publication List


