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A cis-regulatory Element in Intron 1 Cooperates with the Core Promoter during Salinity Induction of Tilapia *Glutamine Synthetase*

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Abstract

Mozambique tilapia (*O. mossambicus*) is a euryhaline fish that tolerates salinity ranging from fresh water (FW) to 120 g/kg (> 3x seawater, SW). Hyperosmotic stress associated with salinity transfer from FW to SW strongly induces *glutamine synthetase* (*GS*) transcription in tilapia, including a brain cell line model (OmB cells). In this study we cloned the 5' regulatory sequence (RS) (including 5'-flanking region and 5'-UTR) of the *O. mossambicus* *GS* gene to identify osmotic response elements that mediate transcriptional induction. Using enhancer trapping, we discovered a novel osmosensitive mechanism that utilizes an unusual enhancer cassette in intron 1 of the *GS* gene. This cassette includes a single copy of a cis-regulatory element (CRE), the osmolality/salinity-responsive element 1 (OSRE1). We show that intronic OSRE1 is necessary but not sufficient for intron 1-mediated hyperosmotic *GS* induction. Furthermore, intron 1 and its interaction with the *GS* core promoter complex are also necessary for hyperosmotic *GS* induction. We propose a novel model for hyperosmotic intron 1-mediated induction of the *O. mossambicus* *GS* gene that is based on the interaction of an OSRE1 enhancer, intron 1, and the core *GS* promoter.

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