Evolution of Alternative Splicing in the MAP215/DIS1 Family of Microtubule Associated Proteins

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XM215, the founding member of the MAP215/DIS1 family of microtubule associated proteins, was first identified in the African clawed frog Xenopus laevis. XM215 is a novel MAP required for formation of mitotic spindles in Xenopus oocytes. In vitro, XM215 has been found to promote microtubule elongation and dynamics specifically at the plus end. Additionally, XM215's activity has been shown to be regulated by phosphorylation during M-phase in Xenopus oocytes and embryos (Gard and Richter, 1997). Two isoforms of XM215 are expressed during Xenopus development. The isoforms are the result of differential splicing, and differ in the presence of a serine and threonine rich sequence of 36 amino acids known as insert 2 (Becker and Gard, 2000). The transcript including the exon encoding insert 2 is expressed in oocytes, eggs, and early embryos, and may be important in regulating the rapid cell cycles of early development in Xenopus. Searches of genome databases revealed that the exon encoding insert 2 is not present in the MAP215 genes of teleost fishes or mammals. A sequence 55% identical and 77% similar to insert 2 has been found in the MAP215 gene of chickens. Based upon these observations, we propose that the insert 2 exon arose in a common ancestor of tetrapod vertebrates and was subsequently lost through deletion or divergence in the MAP215 genes of mammals. This hypothesis was tested by performing sequential RT-PCR and PCR reactions using nested primers to amplify, clone, and sequence cDNAs and genomic sequences spanning the insert 2 exon in MAP215 transcripts and/or genes in a variety of vertebrate species, including: a frog (Rana pipiens), two salmonids (Ambystoma and Necturus), a toad (Bufo sp), a lizard (Anolis carolinensis), and a primate (Homo sapiens). These findings provide evidence for the conservation and evolutionary significance of the insert 2 exon in the MAP215 gene.