

Further evidence that smelt acquired type II antifreeze protein by lateral gene transfer

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Type II antifreeze protein (AFP) is a homologue of the Ca²⁺-dependent C-type lectin family. Although these proteins are ubiquitous, type II AFPs are only found in a few fishes (including smelt, herring and sea raven) from three well-separated branches of the teleost tree. Furthermore, a number of fishes on intervening branches produce other non-homologous AFPs. The high conservation of both exonic and intronic sequences supports the hypothesis that these genes have been transferred laterally rather than lost in most species. We have sequenced and annotated a smelt BAC clone containing a centrally-located AFP gene along with 14 other genes. There is only one copy of this gene in the smelt genome as determined by quantitative PCR, unlike most AFP genes in fish. The equivalent chromosomal region of other species does not contain anything resembling an AFP sequence. As well, unlike the introns of the AFP gene, the intronic sequences of these other genes are not conserved between species. A comparison of the rate and pattern of mutation in the AFP gene is inconsistent with that of other smelt and herring genes. These results further support the hypothesis that the smelt acquired this AFP by lateral gene transfer.

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