# BIOTECHNOLOGY FOR AQUACULTURE: TRANSGENIC SALMON WITH ENHANCED GROWTH AND FREEZE-RESISTANCE

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It is evident that the potential economic benefits of transgenic technology to aquaculture are paramount. The isolation and constrution of genes responsible for desirable traits and their transfer to broodstocks could provide a quantum leap over traditional selection and breeding methods. In addition new traits can be transferred to the genome of one fish from an unrelated species, enabling the production of new economically valuble phenotypes. This study summarizes our results on the production of transgenic salmon for growth hormone (GH) and antifreeze protein (AFF) genes.

We have successfully introduced winter flounder AFP genes into Atlantic salmon. These genes are expressed and the AFP secreted into the blood. The inheritance of $F_3$ suggeats that stable lines of AFP transgenic fish was accomplished. Research is underway to increase the AFP level to provide the concentration required for freezing protection.

Using the promoter from the ocean pout AFP gene (opAFP), we have made two GH gene constructs opAFP-GHc (cDNA clone) and opAFP-GHf (GH minigene), GH transgenic salmon are generated with both Atlantic and Pacific Salmon. Several GH transgenics exhibit faster growth rates and increased size. The average transgenic is 4-6 fold larger compared to injected, nontransgenic siblings.

Furthermore, GHmRNA is detected in the liver of transgenics by RT-PCR. Both the large genotype and phenotype are demostrated in $F_1$ offspring. Our investigation shows that faster growing and larger salmon can be achived by gene transfer technology. These studies demonstrate that the technology will be valuable to aquaculture.

Our outgoing research focuses on the development of the disease-resistant transgenic fish and the criteria and methods for bookstock selection. (Supported by NSERC, Canada).