TRANSGENIC FISH AND AQUACULTURE

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Introdution of foreign DNA into developing embryos by microinjection and electroporation is currently used as a standard method to produce a wide range of transgenic animal species, includingt fish. In addition to conducting basic research, this technique offers exciting potential of improving the genetic background of aquaculture important finfish and shellfish species.Studies conducted in our laboratory and those of others showed that administration of biosynthetic growth hormone of rainbow trout or other fish species to juvenile fish or oyster spat resulted in a significant growth enhancement. The food conversion efficiency of the hormone treated animals is also increased substantially These results point to the possibility of studying the effect of elevated levels of growth hormone on fish growth in different stages of development. Furthermore, biosynthetic growth hormone could also be used to improve the somatic growth of fish in aguaculture.

Although direct application of biosynthetic fish growth hormone may increase the growth rates of cultured fish, several basic studies are still required. These include: (a) methods of large scale preparation of biologically active recombinant growth hormone at low cost: (b) route, dosage and regimen of hormone application: (c) effect of chronic application of the hormone to fish: (d) sasfty concerns for human consuming hormoane-treated fish.

Alternative to the approach of hormone treatment is the production transgenic fish producing elevated levels of growth hormone. Transgenic medaka, common carp and channel catfish have been produced in our laboratory by microinjecting or electroporating gene constructs containing the long terminal repeat (LTR) sequence of Rous sarcoma virus (RSV) or the common carp β-actin gene promoter fused to rainbow trout growth hormone cDNA These transgenic fish not only transmit the transgene into subsequent generations but also grow substantially faster than their non-transgenic siblings. Transgenic medaka carrying carp β-actin gene promoter fused with rainbow trout insulin-like growth factor (IGF) I cDNA have also been produced. Results of these studies showed that transgenic individuals expressing IGF gene hatched, on the average, two days earlier than their control siblings. They also grow significantly faster than the non-transgenic controls. These results suggest that IGF I may also play an important role in growth and development of fish.

In order to realize the full potential of producing fast growing transgenic fish for commercialization, a series of breakthroughs are required.
These include: (I) improving the efficiency of gene transfer; (II) identifying promoters to regulate the expression : of the foreign GH gene at appropriate levels (III) determining physiological, nutritional and environmental factors that will maximize the performance of transgenic individuals; and (IV) assessing food safety and environmental impacts of transgenic fish. (Research supported by grants from NSF, USDA and NOAA-Maryland Sea Grant College).