Genes May Lead Way to Bigger Rainbow Trout

To find a way to make something better, it is best to find out how it works first. For geneticists, that means beginning with an organism's genome.

The genome of every species contains the blueprint that guides life's biological processes. Gaining an understanding of genomes, therefore, can give clues to understanding the mechanisms that drive these processes and provide knowledge to manipulate them for a desired outcome. In aquaculture, the tools and technologies of genomics are being used in selective-breeding programs aimed at production efficiency. Desired outcomes include strains that are disease resistant, stress tolerant, fast and efficient growers, and reproductively manageable.

Molecular biologists Scott Gahr and Caird Rexroad III, of the National Center for Cool and Cold Water Aquaculture in Leetown, West Virginia, are comparing genes known to be responsible for growth and development in mammals with similar genes in rainbow trout.

STEPHEN AUSMUS (K10428-1)

Rainbow trout.

Initial efforts focused on the Inhibitor of DNA Binding/Differentiation *(ID)* genes. The *ID* genes interact with factors present in muscle cells to delay differentiation (the process by which cell function is defined) and increase the number of cells. "Affecting the balance of these processes presents an opportunity to dictate an increase in the number of muscle cells, which would result in more edible flesh on the fish," says Gahr.

Gahr and Rexroad identified four new rainbow trout *ID* genes and further characterized two previously identified genes. *ID1A* and *ID2A* were identified from previously published data. Using a combination of genomic approaches, they were able to identify three more *ID1* genes *(ID1B, ID1C,* and *ID1D)* and one other *ID2* gene *(ID2B).*

The *ID1* genes have similar protein structures and were observed to be expressed in a variety of tissues. Expression of *ID1B* and *ID1C* increased during the middle phase of embryonic development, concurrent with muscle cell differentiation. This suggests that these genes may be important for muscle growth and development.

"One of our goals is to improve growth characteristics for the rainbow trout farmer through genetic selection, and these genes are clearly involved in muscle growth and development," says Rexroad.

Tests were developed and conducted for each of the rainbow trout *ID* genes to determine tissue distribution and embryonic expression. "It's important to know where the genes are expressed to be able to begin to clarify their roles in the fish," says Rexroad. "This illustrates the intertwining of two areas of research interest—physiology and genomics—and the importance of understanding the relationships between them within the organism."

ID gene DNA and mRNA sequences have been entered into GenBank, and expression patterns of the genes in different tissues and time points during embryonic development were published in May 2005. "To facilitate progress in this research area, information on genes must be made available to any scientist interested in doing work that will help the rainbow trout industry," says Rexroad.—By **Sharon Durham,** ARS.

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Scott Gahr and Caird Rexroad III are with the USDA-ARS National Center for Cool and Coldwater Aquaculture, 11861 Leetown Rd., Kearneysville, WV 25430; phone (304) 724-8340 ext. 2133 [Gahr], ext. 2129 [Rexroad], fax (304) 725-0351, e-mail sgahr@ncccwa.ars.usda.gov, crexroad@ncccwa.ars.usda.gov. ✸