Genes behind animal growth discovered

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How many genes influence a complex trait, like weight, height or body type? And why does the answer matter? Among other reasons, because the "Green Revolution" that multiplied crop yields has to be followed by a "Blue Revolution" in ocean farming, according to marine biologists at the University of Southern California.

"We're going to have to make future decisions as a society how to provide enough food for a growing population," said Donal Manahan, co-author of a study on oyster growth appearing online this week in *Proceedings of the National Academy of Sciences Early Edition*.

Currently a delicacy, oysters fed the masses in the past and could again become "the soy bean of the sea" as traditional fisheries collapse, Manahan predicted.

He and senior author Dennis Hedgecock linked growth rate in oysters to approximately 350 genes, or 1.5 percent of the more than 20,000 genes in the oyster genome.

To the authors' knowledge, this is the first estimate of the number of genes that determine growth rate in any animal.

Specifically, the authors discovered the genes responsible for "hybrid vigor," or the ability of some children of crossbreeding to outgrow both parents. Hybrid vigor is of evolutionary as well as agricultural interest because it appears to favor biodiversity.

Many plants have hybrid vigor. Seed companies exploited this property to increase corn yields seven-fold from the 1920s to the present.

Most animals do not express hybrid vigor to such an extent, the authors said. That makes oysters particularly strong candidates for aquaculture.

"Their hybrids grow much faster than either of the parents. And this is exactly like corn," Manahan said.

The PNAS study may lead to improved breeding both on land and sea. The green revolution worked by trial and error, with companies trying every possible cross of corn strains to find the best hybrids.

"A century after its discovery in corn, we still don't know why plants have hybrid vigor, despite the economic and evolutionary importance of this phenomenon," Hedgecock explained.

Knowing the genes for hybrid vigor may enable companies to develop the best cross of corn strains, or oyster types, without guesswork.

The lines would not be genetically modified, only screened and matched as in a dating service.

The goal is efficient and sustainable domestication of oysters and other promising ocean species, mostly shellfish. Oysters already are the number one farmed aquatic species worldwide.

Aquaculture of large fish remains environmentally challenging, Manahan and Hedgecock noted.

Another problem is the apparent lack of hybrid vigor in most fish. Even in oysters, the researchers found the rules of hybrid vigor to be more complicated than predicted by classical ideas in genetics and physiology.

For example, some genes were expressed much less in the offspring than in either parent, a pattern the authors call "underdominance." Very few genes were expressed as the average of the expression in their parents.

Hedgecock called the underdominance patterns "one of the more surprising findings" of the study.

Source: University of Southern California