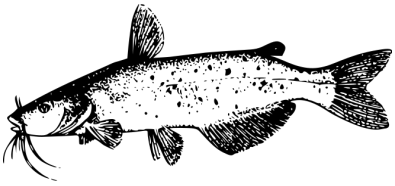
Engineered fish for disease resistance, growth, nutrition, and reproductive control

Auburn University is seeking a licensee or development partner for improved fish as pets or for consumption.



Overview: Ornamental fish and food aquaculture producers face many of the same problems related to disease and growth during production. Faster growing, disease-resistant fish could save producers significantly, but traditional breeding is slow. To speed this process and to control overpopulation concerns of resulting fish, channel catfish were engineered as proof of concept to either be more disease resistant, grow faster, or to control reproduction through hormone therapy. This technology has potential applications in ornamentals as well as food grade fish.

Advantages:

- **DISEASE RESISTANCE -** up to 4X more survival.
- **BETTER GROWTH & NUTRITION -** up to 30% faster to market, higher omega-3s.
- **REPRODUCTIVE CONTROL** - escaped fish won't pose a threat to wildlife.

Multiple engineered catfish have been produced:

Disease Resistance - Insertion of the antibacterial cathelicidin gene from alligator provided up to 70% resistance compared to the unengineered catfish. Because this approach is transgenic, it may be best applied to non-food fish such as ornamentals to avoid regulatory approval.

Omega-3 fatty acids - Insertion of the Elovl2 gene from masu salmon boosted DHA content (docosahexaenoic acid) 62% in muscle and potentially higher in other tissues while EPA (eicosapentaenoic acid) may have also been increased. These fish also exhibit faster growth (up to 49%) and disease resistance (up to 40%). This technology may be suited for sustainable production of fish oil and fish meal if regulatory approval is of concern.

Faster Growth (two approaches) - (MC4R) Gene editing of the MC4R gene in catfish on average reached market size 30% faster (up to 70% in some fish), showed better feed conversion (up to 50%), and increased omega-3 fatty acid DHA up to 21%. **(MSTN)** A similar approach to myostatin knockouts in cattle ("double muscling", e.g. Belgian Blue) was applied to fish. These fish also reach market size 30% faster and show slight improvement in disease resistance.

Reproduction Control - Escape of genetically engineered fish is an environmental concern. By gene editing key hormonal genes (Gonadotropin-releasing Hormone/GnRH, Luteinizing Hormone/LH, Follicle Stimulating Hormone/FSH) reproduction is disadvantaged and restored only with hormone therapy. This gene editing approach helps address regulatory concerns.

Status:

- Issued US patent 11,140,883 and several pending applications.
- Available for exclusive or non-exclusive licensing, co-development, or joint venture.
- Combinations of these genetic engineering approaches is ongoing.

Early Stage → *Small Pond* → *Large Pond* → *Market Ready*

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References:

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