



A Subunit Vaccine for Infectious Pancreatic Necrosis (IPN) Disease in Fish

The Challenge: World aquaculture production, valued at 70.3 billion dollars, is growing more rapidly than any other food-producing sector. Diseases destroy more than 30% of farmed fish before they reach market. Infectious pancreatic necrosis (IPN) is a highly contagious disease of fish, caused by the IPN virus (IPNV), affecting the salmon and trout aquaculture industry. Disease caused by IPNV in farmed salmon costs about 100 million dollars a year in Norway alone! As fish farms and closed aquaculture systems become more important as food sources, vaccines to treat fish will become a necessity. A single fish with IPNV can destroy 100% of the fish in a tank and cause high mortality of salmon in a pen after transfer from freshwater to seawater. Destruction of the fish is the only method currently available on a commercial basis for eliminating the virus in infected carrier fish. Although several international companies are producing inactivated viral IPNV vaccines, there is a need for a more effective and easily deliverable vaccine to immunize a large number of fish economically.

UMBI Solution: A UMBI inventor has developed a safe, economical, and effective subunit vaccine for IPNV. The inventor has cloned and expressed the structural viral proteins, encoded by the IPNV VP2 and VP3 genes in a baculovirus insect-cell system and has synthesized correctly folded IPNV proteins that self-assembled to form "virus-like" particles. These particles are able to induce protection against wild-type IPNV serotype.

Commercial Applications:

- Vaccine for aquaculture – sub-unit vaccines for IPNV based on the structural proteins VP2 and VP3 folded as an empty IPNV viral capsid without the RNA genome

Advantages:

- Recombinant proteins can be mixed with the feed and administered orally
- Overcomes limitations of prior vaccine delivery methods such as intra-peritoneal injection
- Can be easily produced and does not require a new process for scale-up
- The proteins that are expressed are post-translationally modified and correctly folded into the conformational structure that exposes neutralizing epitopes

Relevant Publications:

1. Shivappa RB, McAllister PE, Edwards GH, Santi N, Evensen O, Vakharia VN. Development of a subunit vaccine for infectious pancreatic necrosis virus using a baculovirus insect/larvae system. *Dev Biol* 2005; 121:165-174.
2. Allnutt FC, Bowers RM, Rowe CG, Vakharia VN, LaPatra SE, Dhar AK. 2007. Antigenicity of infectious pancreatic necrosis virus VP2 subviral particles expressed in yeast. *Vaccine*; 2007 Jun 21;25(26):4880-8.
3. Song H, Santi N, Evensen O, Vakharia VN. 2005. Molecular determinants of infectious pancreatic necrosis virus virulence and cell culture adaptation. *J Virol*. 2005 Aug; 79(16):10289-99.

Stage of Development: In preliminary studies, a single dose of baculovirus-expressed experimental vaccine (containing virus-like particles) was injected to pre-smolts of Atlantic salmon. After the challenge with a virulent IPNV strain, the cumulative mortality rate of immunized fish was lower (56%) than the control fish (77%) and partial protection was afforded by the recombinant vaccine (RPS =27%). In another pilot study, yeast-expressed recombinant VP2 was delivered by either intraperitoneal (IP) injection or orally in feeds, and a specific immune response against IPNV was detected in vaccinated fish.

Patent status: Multinational PCT patent application pending; US Patent Number 6,936,256, Issued 8/30/2005, "Sub-unit vaccine for infectious pancreatic necrosis virus"

Licensing Potential: UMBI is seeking non-exclusive and exclusive licensees to all or part of this technology. The inventors would welcome the opportunity to work with any licensee to further refine or extend the capabilities of this invention.

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