IMPLICATION OF BIOLOGICAL AND SYNTHETIC NANOPARTICLES IN EVOLUTION AND DEVELOPMENT OF ANTIBIOTIC RESISTANCE RELEVANT FOR AQUACULTURE

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Abstract

The endemic intracellular pathogens *Francisella noatunensis* and *Piscirickettsia salmonis* are among the most severe threats to the worldwide fish farming industry, as there are currently no satisfactory vaccines available. The bacteria induce quite similar diseases, francisellosis and rickettsiosis, which are characterized by symptoms like discoloration, reduced swimming ability, swollen kidney and spleen, formation of granulomas and occasionally high mortalities, especially in farming enclosures. The bacteria have been shown to secrete outer membrane vesicles (OMVs), which have been proposed as vaccine candidates for the pathogens, but they have shown mixed protection and extremely varying levels of virulence, even among very similar subspecies. In conjunction with these vaccine experiments, the proteomics of the OMVs have been mapped to some extent, but their possible content of RNA and DNA is largely unexplored. OMVs from other Gram-negative sources have been shown to carry DNA and transfer resistance genes between bacteria, so there is significant reason to suspect that this is the case with *F. noatunensis* and *P. salmonis* as well. Furthermore, little is known on whether specific sequences of DNA are preferentially secreted in these OMVs, or if the inclusion is merely a random fragment of the genome or any present plasmid. It is known that the genomes of some *Francisella* spp. are populated by transposable elements, and bacterial transposons are known for their ability to transmit antibiotic resistance. This naturally raises the concern of how the use of OMVs as vaccines could be affecting the rate of which antibiotic resistance genes are transferred within the bacterial population. With these considerations in mind, the aim of the project is 1) to confirm or disprove the presence of DNA in OMVs from *F. noatunensis* and *P. salmonis*, 2) Get quantitative sequence data on this content to assess preferential packing of DNA and 3) attempt horizontal antibiotic resistance gene transfer by OMVs.

Keywords

Francisella, Piscirickettsia, vaccine, antibiotic resistance, evolution.

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