ParaFishControl

A recombinant vaccine targeting the fish parasite *Ichthyophthirius multifiliis*

ParaFishControl Final Conference

"Innovative Strategies to Control Parasites in Aquaculture Farms"

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Challenge and Impact

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➢ Challenge

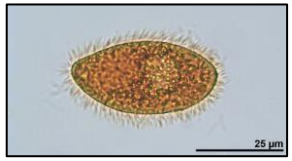
Ichthyophthirius multifiliis (*Ich*) is a unicellular parasite that infects almost all freshwater fish species - production fish as well as ornamental fish.

It infects gills, skin and fins.

The parasite multiplies fast dependent on temperature.

One parasite (white spot in the skin) may develop into 1000 new within two days.

➢ Impact



Ich causes high mortality in both production and ornamental fish species.

Without treatment, it will kill the host population within a few days.

Economic losses for the fish farmers both due to loss of fish and wasted feed and labour.

Bottleneck for a production increase of commercial important fish species.

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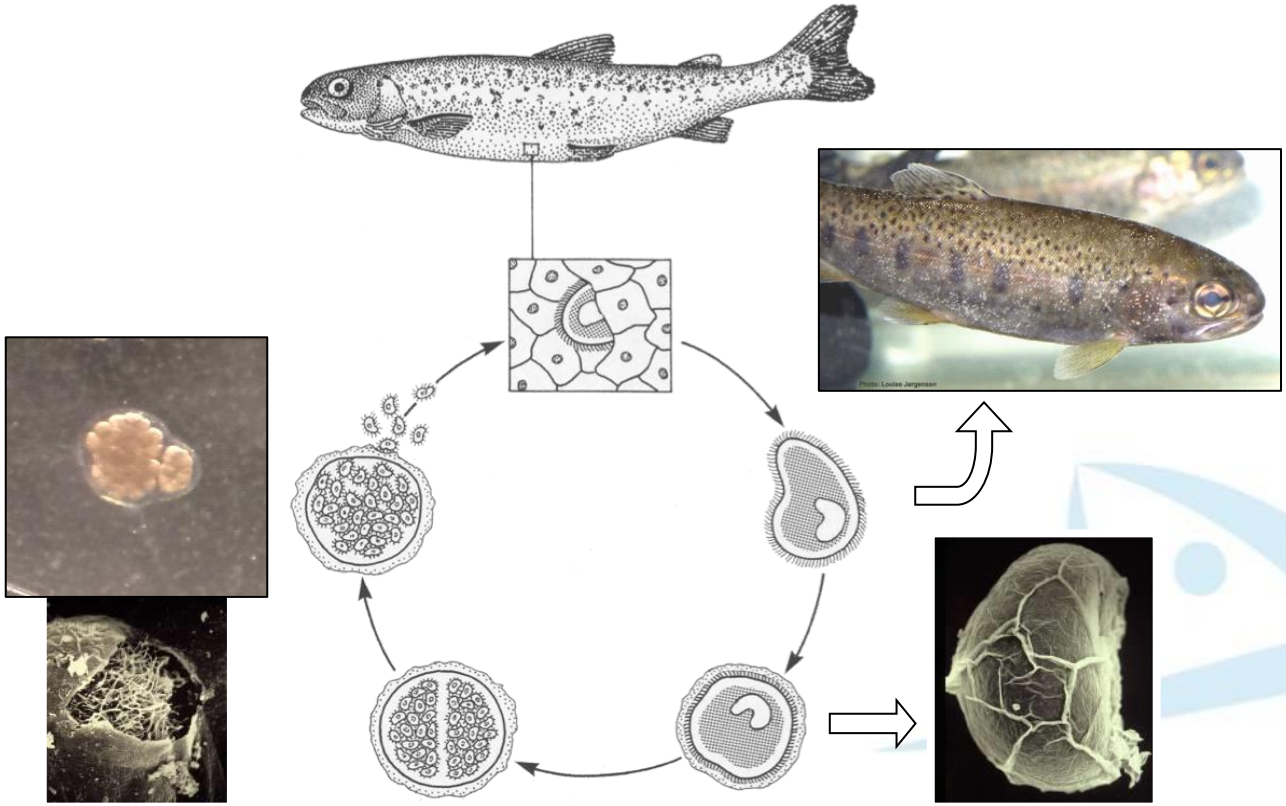
Life cycle



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Challenge by adding infective Theronts to the fish tank

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High mortality if left untreated

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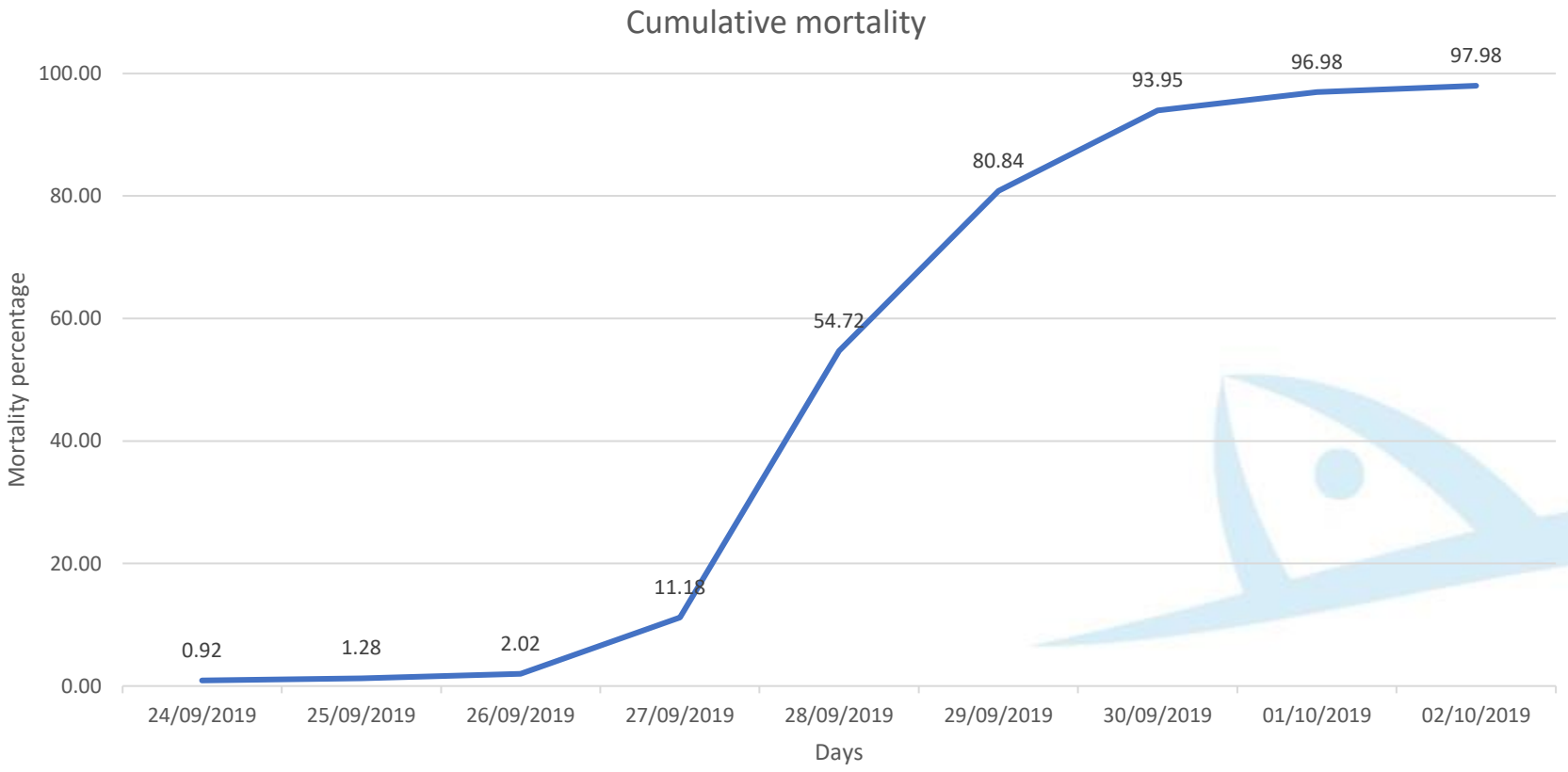

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The immunoprophylactic approach

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- **Brief description of the proposed solution**

AIM: Use artificial intelligence identifying protective antigens to develop a recombinant sub-unit vaccine against the fish parasite *I. multifiliis*

- **Team involved in the development**

- PFC P9 KU, Frederiksberg, Denmark
- PFC P10 MTA, Budapest, Hungary
- PFC P26 W42 GmbH, Germany
- PFC P5 DTU, Lyngby, Denmark
- Department of Cancer and Inflammation Research, University of Southern Denmark, Denmark.
- Evaxion Biotech, Denmark.
- Centre for Medical Parasitology at the Department of Immunology and Microbiology, University of Copenhagen, Denmark

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The vaccine solution

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A novel technology (EDEN) identifies B-cell antigens using neural networks. The neural network trains on already known B cell antigens – and learns to identify them

The *I. multifiliis* proteome was screened

12 proteins as potential vaccine candidates were considered (out of 7181 proteins)

3 proteins were selected for the experiment based on functionality, subcellular location and putative protective structural domain – and successful recombinant expression

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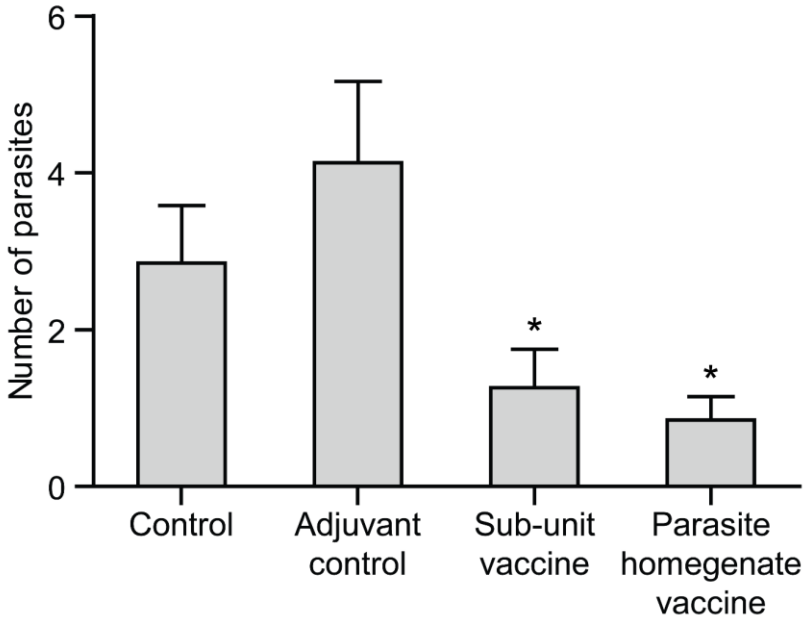
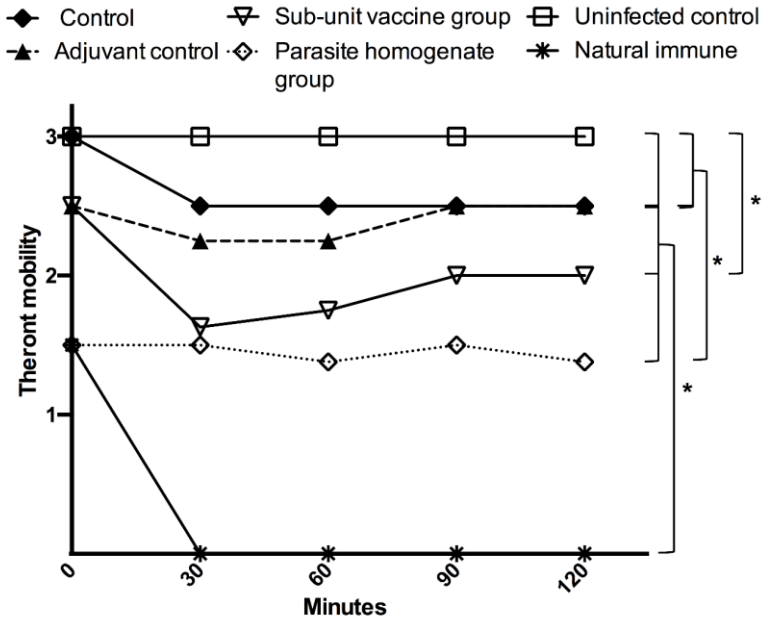
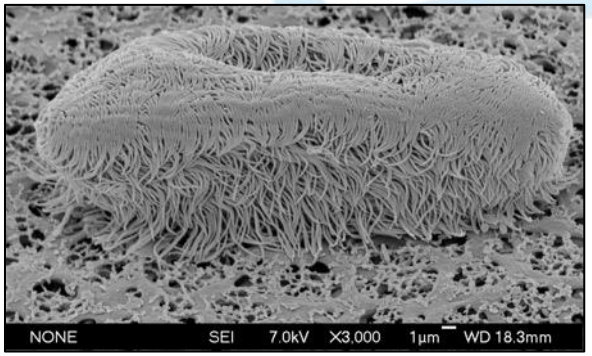
Vaccine efficacy







Moderate protection

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Antibodies

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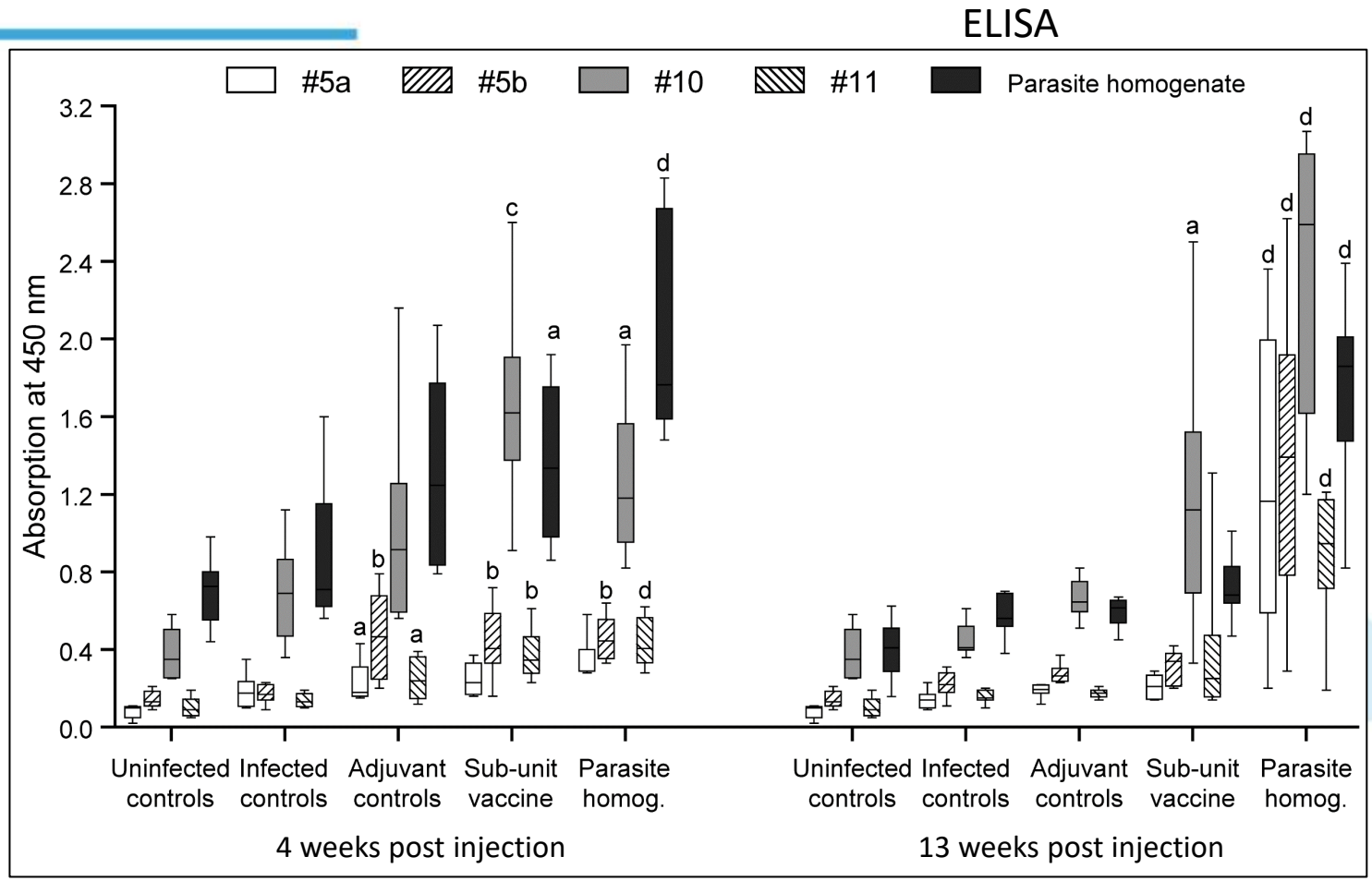

Solution: Use recombinant #10 and further develop the vaccine for a prophylactic approach to protect fish against *Ich*

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Vaccines vs currently employed solutions

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➢Our solution

Optimize the vaccine

It is not safe at present

Combination with other antigens a possibility

Adjuvants may improve efficacy

Then an efficient vaccine presents a safe and efficient way of controlling *Ich*

➢Currently employed solutions

Repeated treatments with formalin, hydrogen peroxide and peracetic acid or probably novel parasiticidal compounds

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Expected benefits for the industry

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- Prophylactic approach is preferred to treatment
- Improved health status of European farmed fish
- Improved welfare in fish farms
- Improved sustainability of European aquaculture
- Increased productivity in European fish farms
- Elevated economic result in European aquaculture

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Current status and next steps

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Patent: EP2017/064899

Improving immunogenicity of the antigens and efficiency of the vaccine

- Discover and include additional novel immunogenic recombinant antigens
- Use a more efficient adjuvant

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Conclusions

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We found a novel protective antigen from *Ich* that induce moderate protection in rainbow trout

The vaccine needs improvement

With a cheap vaccine against *Ich* the industry would benefit economically and fish welfare would increase.

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Thank You

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