

PhD - project: Understanding the Sea Lice parasite – host metabolic interaction

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Background:

Infection and spread of sea lice are one of the major challenges for the Norwegian salmon industry, and the dramatic increase in sea lice infection affecting the growth and profitability of the whole industry. Sea lice infections have strong impact on the fish health and welfare, as well as being of concern with respect to wild salmonid stocks. The ectoparasitic sea lice have 2 nauplii stages and the first copepodite stage that are planktonic. The latter is also the infective stage when the sea lice will attach to the salmon skin through frontal filaments. They will feed on mucus, skin and blood until reaching pre-adult and adult stages. These are mobile stages where the salmon lice will migrate to preferred areas on the salmon. The pelagic stages of sea lice are attracted to the salmon through physical and chemical stimuli (can recognize signal molecules from the fish). After attachment to the salmon the sea lice produce immunosuppressive compounds in order to circumvent the salmon's immune system.

Aim:

The project will aim to understand the mechanisms and processes occurring during sea lice infection in Atlantic salmon. By identifying the metabolic and transcriptomic changes that occur during early sea lice infestation this project will provide new knowledge that can be valuable for developing targeted drugs or treatments to control the level of infections seen in aquaculture today.

Tasks:

The project will use a systems biology approach to gather information through transcriptomics, metabolomics and to some extent proteomics. The present PhD-project proposal includes the following tasks:

1. The salmon produce metabolic substances that the infectious stages of sea lice recognize and stimulate the lice to attach to the fish. The condition of the mucous layer of the fish will determine if and how the sea lice will attach. Knowledge of the mucous layer and production of metabolic substances by the salmon is important for explaining how the sea lice infect the fish.
2. The naupli and copepodite stage of the sea lice will attach to salmon both by physical and chemical stimuli. When the sea lice have infected a salmon they will start to produce immune suppressing compounds that will hinder the immune system of salmon. The chemical interactions of this infection will be studied.

The PhD candidate will take advantage of the competence and research infrastructure at NTNU Department of Biology: 1). NTNU Seelab laboratories for conducting controlled experiments on sea lice and salmon, 2). Access to ACE (Aquaculture Engineering Research Infrastructure) for performing large scale tests and verification studies, 3). The metabolite characterization laboratories (metabolomics) at NTNU including GC-MS, LCMS, HPLC and NMR at Gløshaugen, and 4). Laboratories for transcriptomic and general molecular biology analyses at Gløshaugen

Qualifications:

The applicant must have an MSc (or equivalent) and a documented background in biological, marine chemistry/biochemistry and/or molecular biological methods. Experience and knowledge in informatics will be regarded as an advantage. Knowledge on experimental methods for conducting experiments in the field and laboratory (biochemical and molecular biology analysis) is important. The candidate will be required to participate in the sea lice lab in Trondheim.