

DOCTORAL CANDIDATE: Bastian Fromm

DEGREE: Philosophiae Doctor

FACULTY: Faculty of Mathematics and Natural Sciences

DEPARTMENT: Natural History Museum

AREA OF EXPERTISE: Molecular Biology and Evolution, Bioinformatics, Parasitology, and Genomics

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DISSERTATION TITLE: *Occurrence and phylogenetic implications of microRNAs in the fish parasite Gyrodactylus salaris (Platyhelminthes: Neodermata: Monogenea) and related species.*

I doktorgradsarbeidet sitt viser Bastian Fromm at lakseparasitten vi kjenner som *Gyrodactylus salaris*, egentlig er ei farleg stamme av ein mykje vanlegare art, noko som utfordrar den rådande politikken. Funna hans om mikro-RNA hos *G. salaris* føyer viktig innsikt til forståinga av evolusjonen av mikro-RNA i dyr.

MicroRNAs are the most recently discovered type of gene regulators. They show high conservation across all animal lineages. *G. salaris* - known as the ‘russian doll killer’ - is an economically important and biologically very interesting ectoparasite that causes gyrodactyliasis in Atlantic salmon in Norway. Fromm et al. could show that commercially available RNA-extraction methods differ significantly in their RNA yield. This was achieved by solving the methodological challenges set by the size of the worms (0.5 mm) and by the fact that the microRNAs were only ~22 nucleotides long. Due to the small sample sizes, some of the existing RNA extraction methods were demonstrated to repeatedly fail in yielding any measurable microRNA fractions; a finding that will certainly impact on the work of other researchers. Applying modern Next Generation Sequencing technology together with his innovative bioinformatics pipeline, called miRCandRef, the microRNA complement of the parasite was successfully compiled. However, the major discovery of the work unfolded when Fromm et al. compared their data to available microRNA complements from other flatworms. A substantial loss of conserved microRNA families was found for different flatworms. This may be linked to their different (parasitic) lifestyles. Surprisingly, the distribution pattern of the microRNA losses unambiguously supported one of the previously argued phylogenetic hypotheses for flatworms. These discoveries were reinforced by the findings of massive gene losses by the *G. salaris* genome project, in which Fromm was a participant.

For management of the parasitic situation in salmon, it is very important to understand the taxonomical situation of the parasite. The species status of *G. salaris* and its harmless sister species *G. thymalli* has been debated ever since their description of the two species in 1957/1960. Conducting a genome-wide analysis of the 37 conserved microRNA-loci (~21 kb) from seven populations of *Gyrodactylus salaris* and *G. thymalli*, Fromm et al. tested their status. No support for the existence of the two independent species could be found. Consequently, Fromm et al. synonymized both species to a single species, *G. salaris*, which implies that its range is significantly expanded covering essentially the full continental Europe and Great Britain. This implies a severe challenge to current disease management routines, which all assume that *G. salaris* and *G. thymalli* are readily distinguishable.