Parasite infection mediates intergenerational DNA methylation in the three-spined stickleback *(Gasterosteus aculeatus)*

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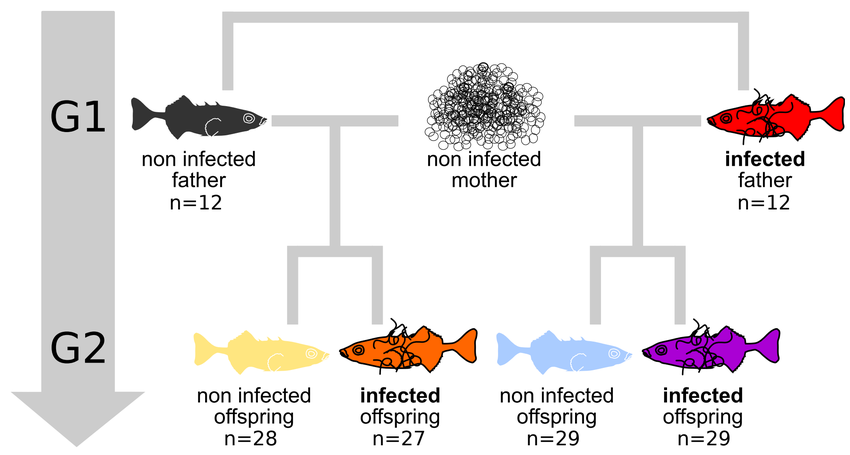
1. Paternal infection by the nematode *Camallanus lacustris* is associated with increased selection in offspring but also increased tolerance upon infection[1]
2. Genome-wide DNA methylation patterns differ between infected and control fish, demonstrating the link between infection and DNA methylation[2]

Can parental DNA methylation induced by the parasite infection be transmitted to the next generation, and is it an underlying mechanism of the observed phenotypic differences?

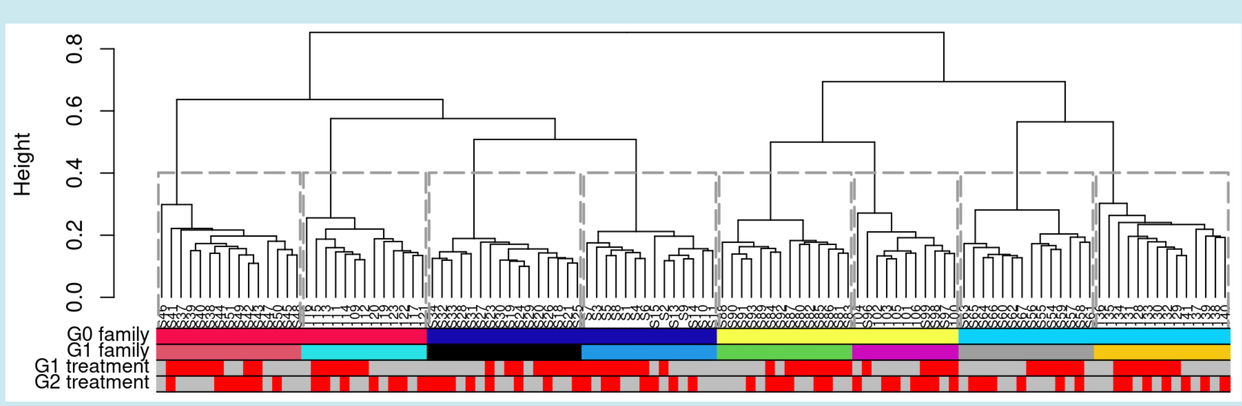
Material & methods

- Methylome sequencing: **Reduced Representation Bisulfite Sequencing** single-end reads of 100bp long, Illumina HiSeq 2500. Alignment on a European gynogen genome[3] and methylation call with BSBolt. Downstream analyses with Methylkit.
- Positional methylation:
  Q1.Is genetics or treatment a stronger predictor of methylation?
  Q2.Is the methylation pattern affected by paternal/offspring treatment?
- Differential methylation in half the brother pairs (4/8): **Q3.What are the specific differences between paternal/offspring treatment groups?**
- PCA of methylation at differentially methylated sites, linear model of Body Condition Index explained by the 2 first axes, the number of worms, paternal treatment, and interactions: **Q4.Can we find a link between methylation and phenotype?**

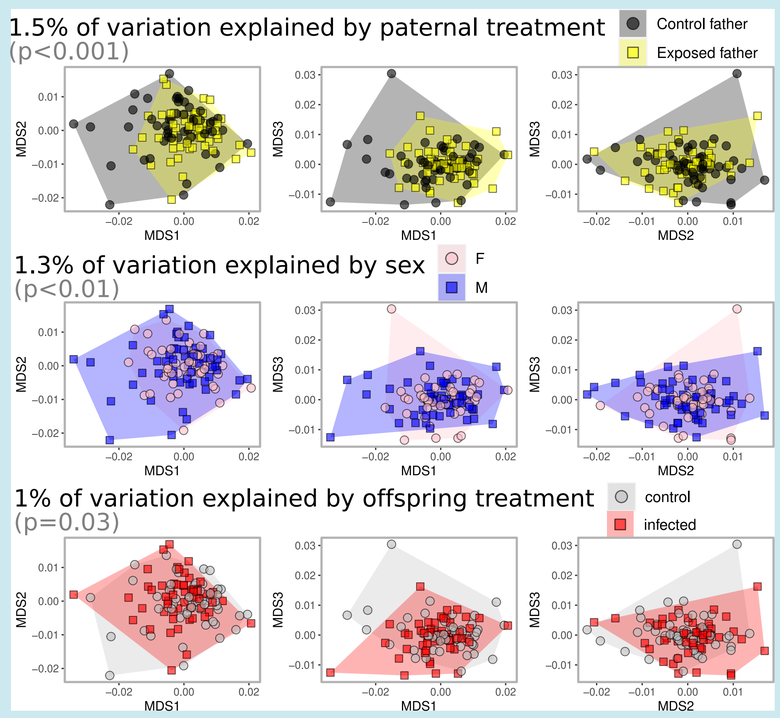
Experimental design



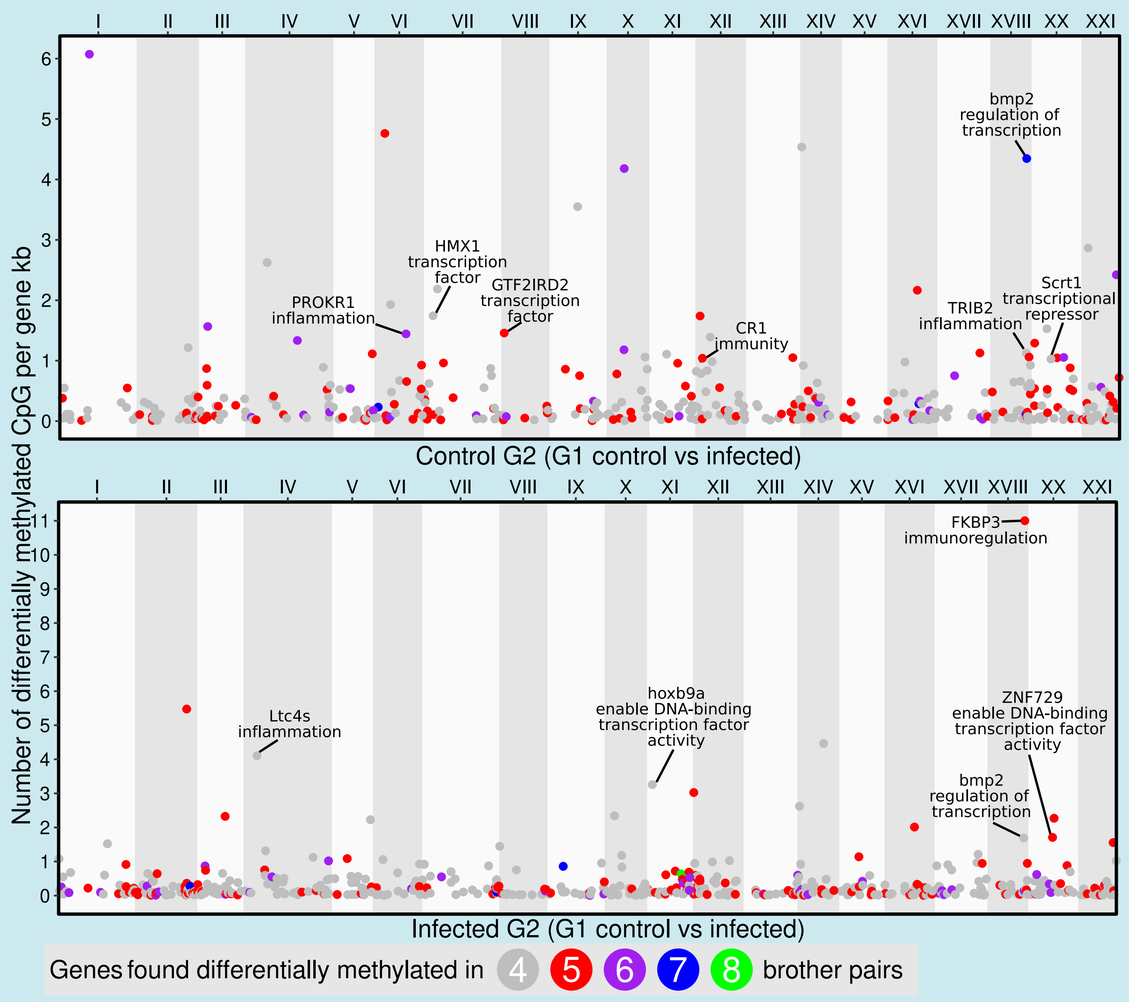
Q1.DNA methylation profiles cluster by genetic background



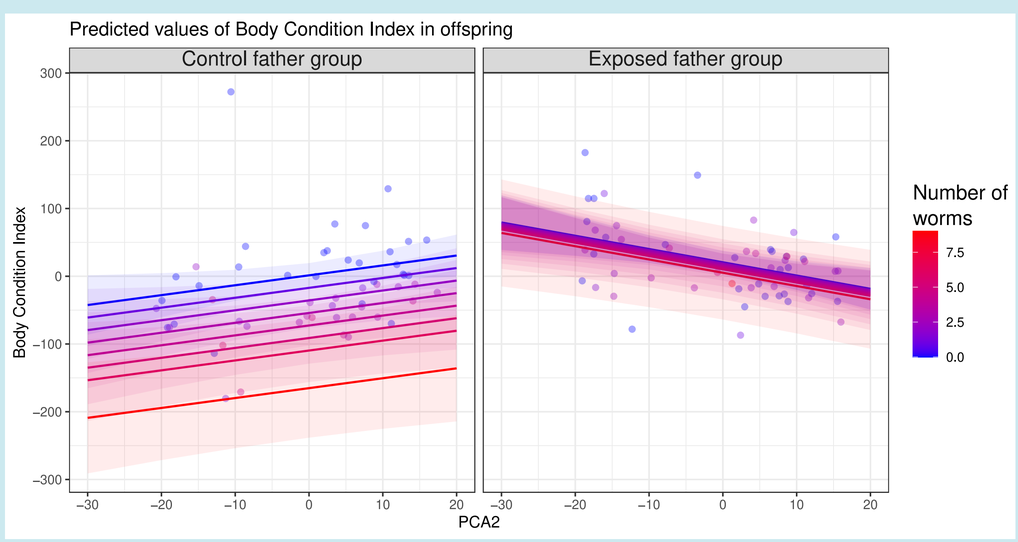
Q2.Methylation is more affected by the paternal infection than by the offspring infection itself



Q3.Specific methylated sites linked with paternal infection are associated with genes related to immunity and transcription



Q4.Body condition correlates with methylation at differentially methylated sites, in different directions depending on the paternal treatment



[1]Kaufmann, J., Lenz, T. L., Milinski, M., & Eizaguirre, C. (2014). Experimental parasite infection reveals costs and benefits of paternal effects. Ecology Letters; [2]Sagonas, K., Meyer, B. S., Kaufmann, J., Lenz, T. L., Häsler, R., & Eizaguirre, C. (2020). Experimental parasite infection causes genome-wide changes in DNA methylation. Molecular Biology and Evolution; [3]Thornburn et al., in prep.

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