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

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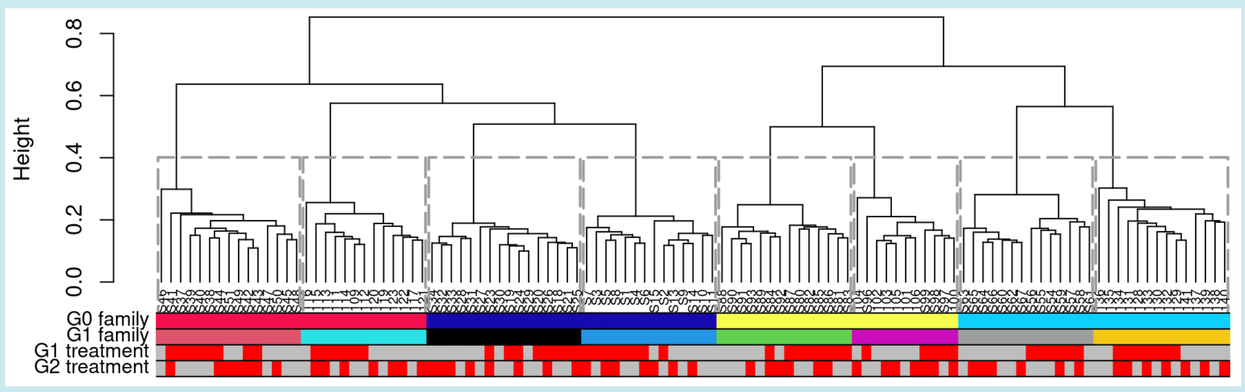
1. Paternal infection by the nematode *Camallanus lacustris* is associated with increased selection in offspring but also increased tolerance upon infection[1]
2. Genome-wide DNA methylation patterns differ between infected and control fish, demonstrating the link between infection and DNA methylation[2]

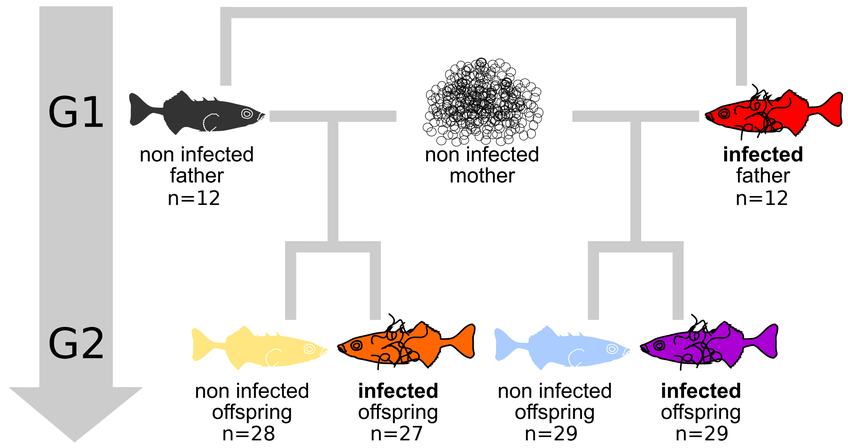
Can parental DNA methylation induced by the infection be transmitted to the next generation, and is it an underlying mechanism of the observed phenotypic differences?

Material & methods

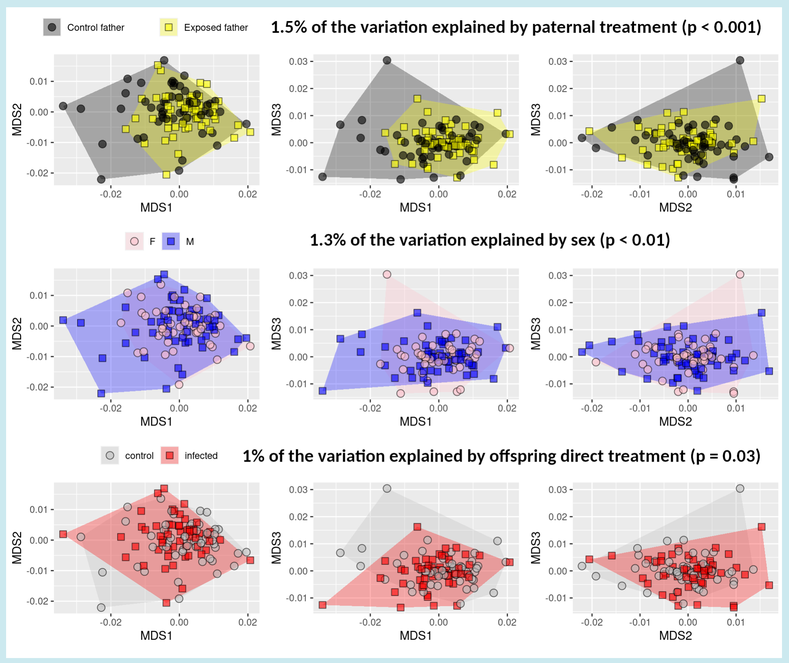
- Methylome sequencing: **Reduced Representation Bisulfite Sequencing** single-end reads of 100bp long, Illumina HiSeq 2500. Alignment on a European gynogen genome[3] and methylation call with BSBolt. Downstream analyses with Methylkit
- Positional methylation:
  - **Is the methylation pattern affected by paternal/offspring treatment?**
- Differential methylation:
  - **Which are the specific differences between paternal/offspring treatment groups?**
  - **Can we correlation theses positions with the phenotype?**
- **Link methylation and phenotype**:
  - PCA of methylation values at sites which are differentially methylated in at least 4 out of 8 brother pairs
  - Extract first and second axes
  - Linear model of Body condition index explained by: PCA1 * PCA2 * Number of worms * Paternal treatment

1. DNA methylation profiles cluster by genetic background

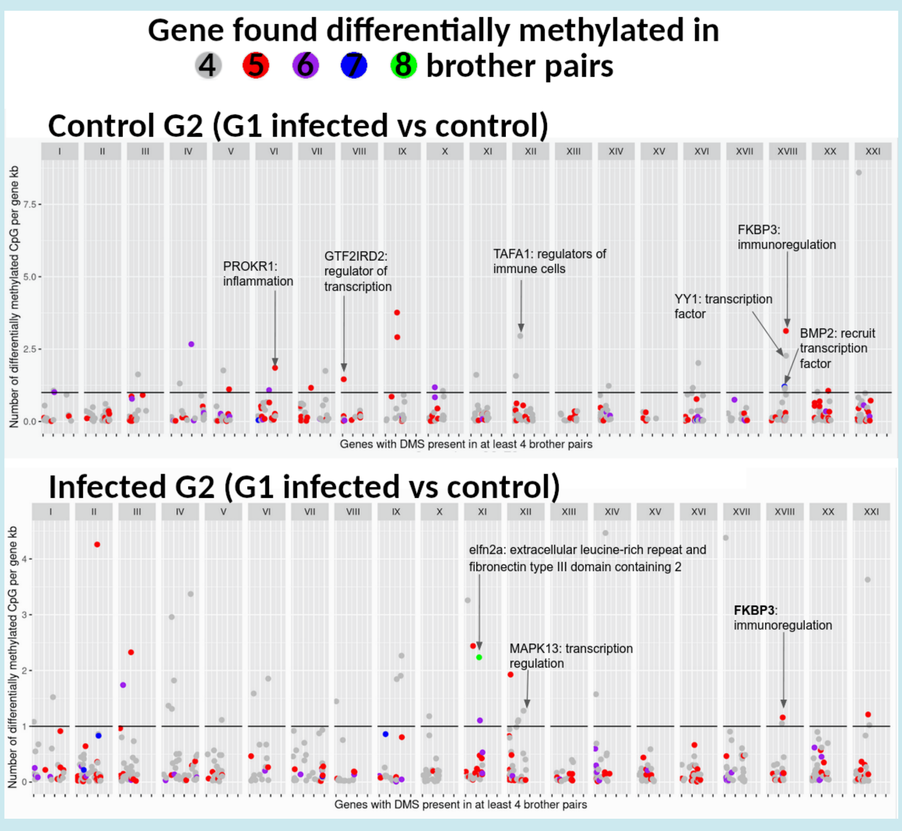




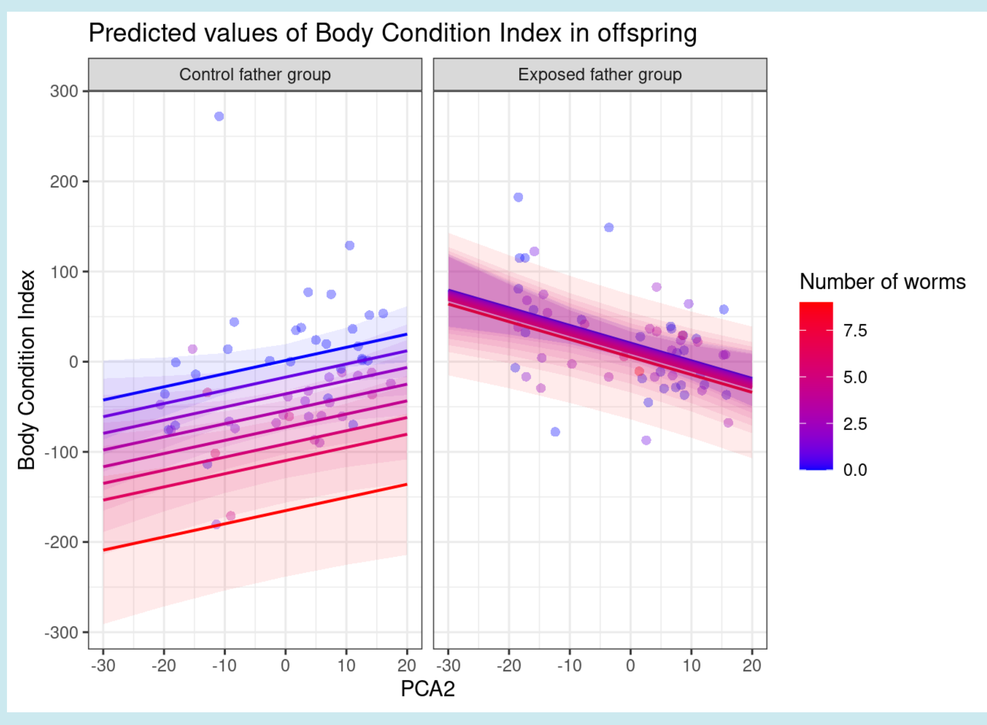
2. Methylation is more affected by the paternal infection than by the offspring infection itself



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



4. Body condition correlates with methylation at certain positions, 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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