Master's Research Opportunity:

Investigating the role of gut bacteria on pain perception using *Drosophila*

The intricate relationship between the **gut microbiome and brain function** is an emerging frontier in neuroscience and microbiology. While gut microbes are known to influence various aspects of physiology, their role in modulating pain perception remains poorly understood. This Master's project will leverage the genetically tractable model organism ***Drosophila melanogaster*** to investigate how specific gut bacteria and their gene products impact nociception—the perception of painful stimuli. With its simplified microbiome dominated by a few bacterial species, *Drosophila* presents an ideal system for uncovering causal relationships between microbial factors and pain modulation. This research has the potential to provide foundational insights into how microbial communities shape host sensory processing, with broader implications for neuroscience, microbiology, and even therapeutic innovation.

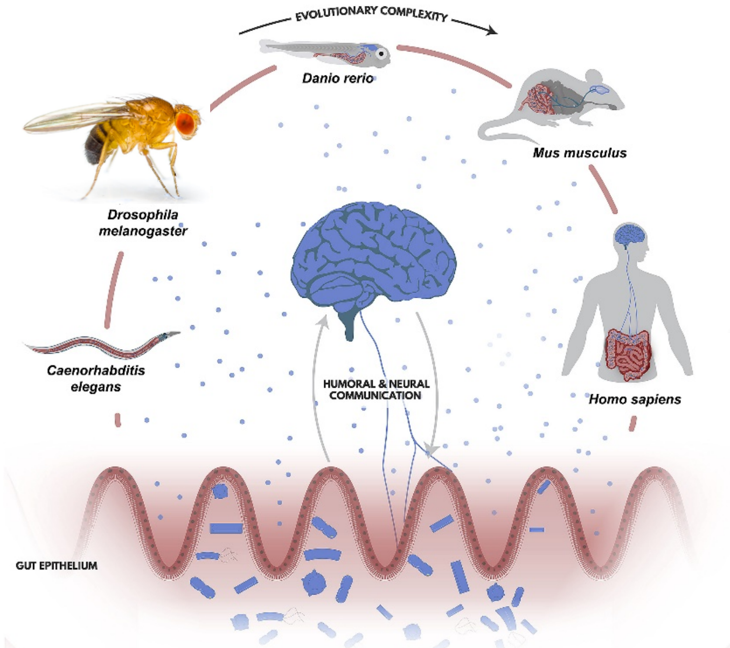

Figure 1. Microbiota-gut-brain signaling in humans and in model animal systems, including *Drosophila melanogaster*. Nagpal &

As part of this project, the student will employ an interdisciplinary approach combining microbiology, genetics, and behavioral neuroscience. The experimental plan involves generating germ-free *Drosophila* larvae and colonizing them with specific bacterial strains to assess their impact on thermal nociception using established behavioral assays. Cutting-edge techniques such as microbial genetic manipulation, high-throughput screening, and quantitative behavioral analysis will be employed to identify bacterial species and metabolites that influence pain sensitivity. By working within a collaborative environment that bridges microbiology and neuroscience, the student will gain hands-on experience in both microbial cultivation and *Drosophila* sensory biology. **The project will be conducted as part of a close cross-Faculty collaboration between the** [Selkrig Lab](#) (RWTH University Hospital Aachen, Institute for Medical Microbiology) **and the** [Tavosanis Lab](#) (RWTH University, Developmental Biology).

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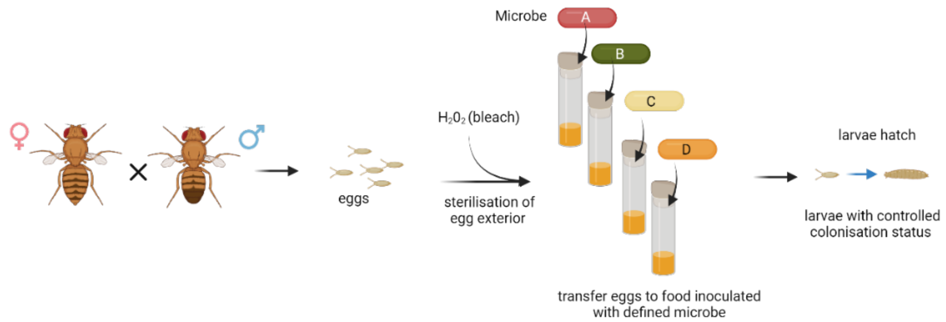

Figure 2. Procedure for generating *Drosophila* larvae with a defined microbiota. Flies colonised with different microbial species will be tested for their nociceptive behaviour as described

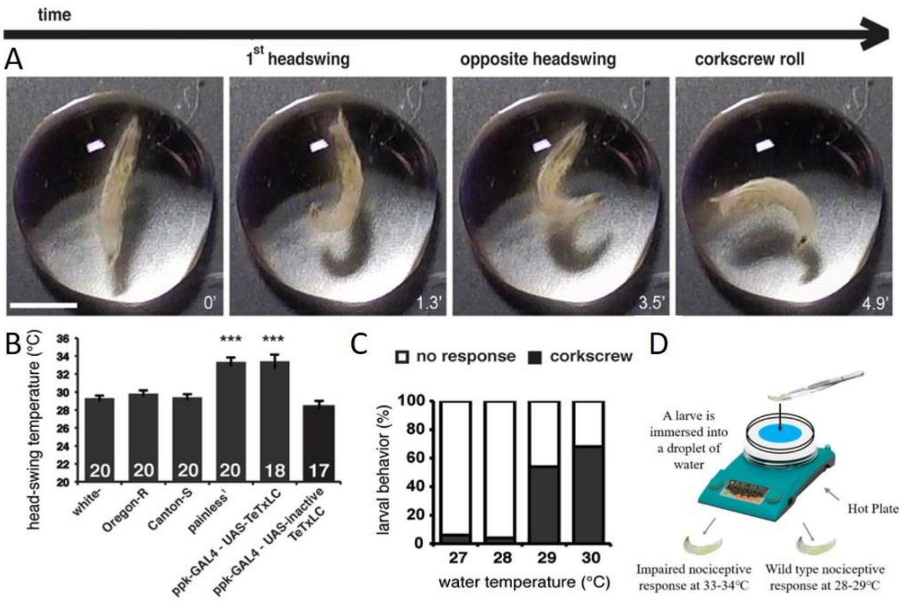

Figure 3. *Drosophila* larvae nociceptive response to heat (**A**) Third instar larvae respond with a lateral head thrash followed by a whole body corkscrewing motion when the water temperature rises to 29°C. (**B**) Wild-type and control (inactive TeTxLC) larvae respond with an escape behaviour at 29°C, larvae mutant for *painless* or defective for function of the c4da neurons (TeTxLC) have a delayed response at 33°C (***p < 0.001, Student's t-test). Numbers within bars = n, error bars are SEM. (**C**) Wild-type and control larvae directly immersed in water of increasing temperatures respond at temperatures of 29°C and above. (From(Oswald et al. 2011)). (**D**) Heat plate assay (From(He et al. 2022)).

This project is an excellent opportunity for a motivated Master's student with a background in molecular biology, microbiology, neuroscience, or related fields. The student will be co-supervised by experts in bacteriology and *Drosophila* neurobiology, ensuring a dynamic learning experience in an exciting and rapidly growing field. The findings from this research will contribute to a larger initiative aimed at uncovering microbial factors that influence sensory processing, with potential applications in pain management and microbiome-based therapeutics. If you are passionate about host-microbe interactions and/or neuroscience, this project offers a unique chance to explore an uncharted aspect of how microbes influence animal behavior.

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