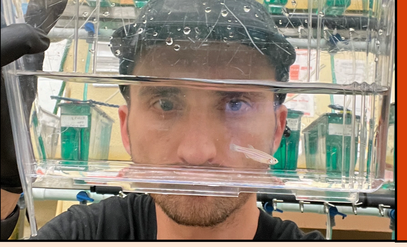

How do external environmental factors impact the gut microbiome to influence host health?

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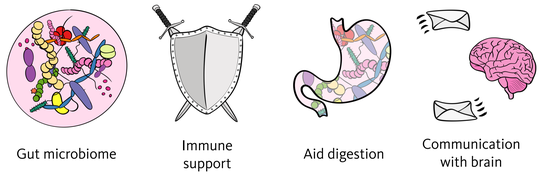
Background

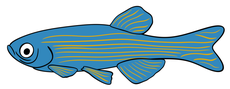
Gut Microbiome:

- The gut microbiome is the collection of microorganisms (bacteria, archaea, viruses) that inhabit a host organism's gastrointestinal tract (mouth to anus)
- The gut microbiome aids its host in digestion and absorption of nutrients, supporting the immune system, & communicating with the nervous & endocrine systems
- The microbiome is relatively stable, but if disturbed it can become unstable and jeopardize the host's health



Zebrafish:

- Zebrafish are an ideal model organism because they have many well established, high-throughput protocols
- Simple microbiomes and share 70% genes with humans
- Unlike mice, no standardized diet for studies
- Typically inhabit 28°C fresh water
- Zebrafish facilities are often contaminated by pathogens or parasites, causing non-protocol induced variation in study results

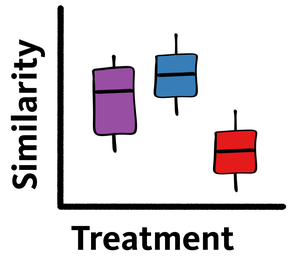


Broader Impacts

By better understanding the underlying mechanisms that drive the microbiome:

- Develop microbiome-targeted therapies to support host health
- Mitigate harmful impacts of anthropogenic climate change
- More optimally manage wildlife, livestock, agriculture and human health

1) Sensitivity



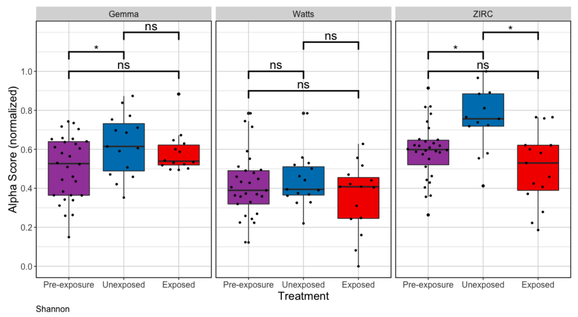
Questions:

- How sensitive is the microbiome to an environmental factor?
- What are the long-term impacts on the development of the microbiome?

Methods: Explore with dietary and pathogen exposure model

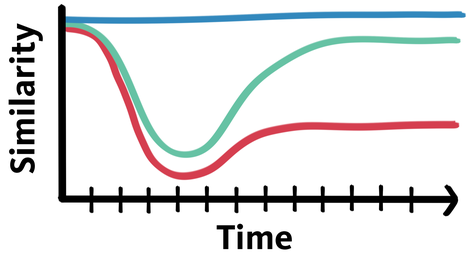
- Fish were fed one of three diets
- Half the fish were exposed to a common zebrafish pathogen
- We measured their gut microbial diversity at 3 & 6 months of age

Results: Gut microbiome's sensitivity to pathogen exposure was linked to diet



- The gut microbial diversity (alpha score) differed by diet
- ZIRC diet fed fish had higher microbial gut diversity than fish fed the Gemma or Watts diets
- Pathogen exposure inhibited diversification in ZIRC diet fed fish, but not in fish fed the other two diets

2) Resiliency



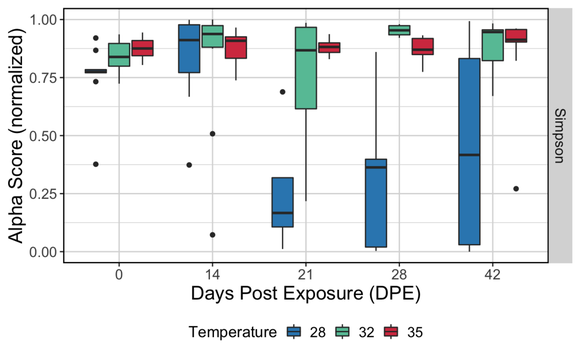
Questions:

- Can the microbiome recover from environmental exposures to which it is sensitive?
- Is recovery linked to health?

Methods: Explore with temperature and parasite exposure models

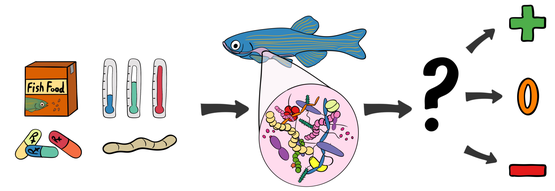
- Fish were reared at 28, 32 & 35°C water
- Half the fish were exposed to parasitic worms
- We measured their gut microbial diversity at 0, 14, 21, 28 & 42 days after exposure

Results: Gut microbiomes in 28°C were not resilient to temperature and parasites



- Fish exposed to higher temperatures had higher microbial diversity (alpha score), and vice versa
- Fish at 28°C were most impacted by parasite exposure

3) Mediation



Questions:

- Do changes to the microbiome drive variation in health outcomes?
- What are the underlying functions of the microbiome that yield these effects?

Future work: Explore with a multi-factor exposure study using antibiotics

- Assess how environmental impacts to the gut microbiome result in differential health outcomes for the host organism
- Using a multi-factor exposure study involving antibiotics, parasites and temperature

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More Info

- Find out more about our research at lab.sharpton.org
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