

# Raising robust chickens through black soldier fly larvae meal

Increased gut microbiome diversity demonstrated in two commercial strains of laying hens with unique microbiomes when fed black soldier fly larvae meal (*Hermetia illucens*)

Jing Lu, PhD Student  
Dalhousie University

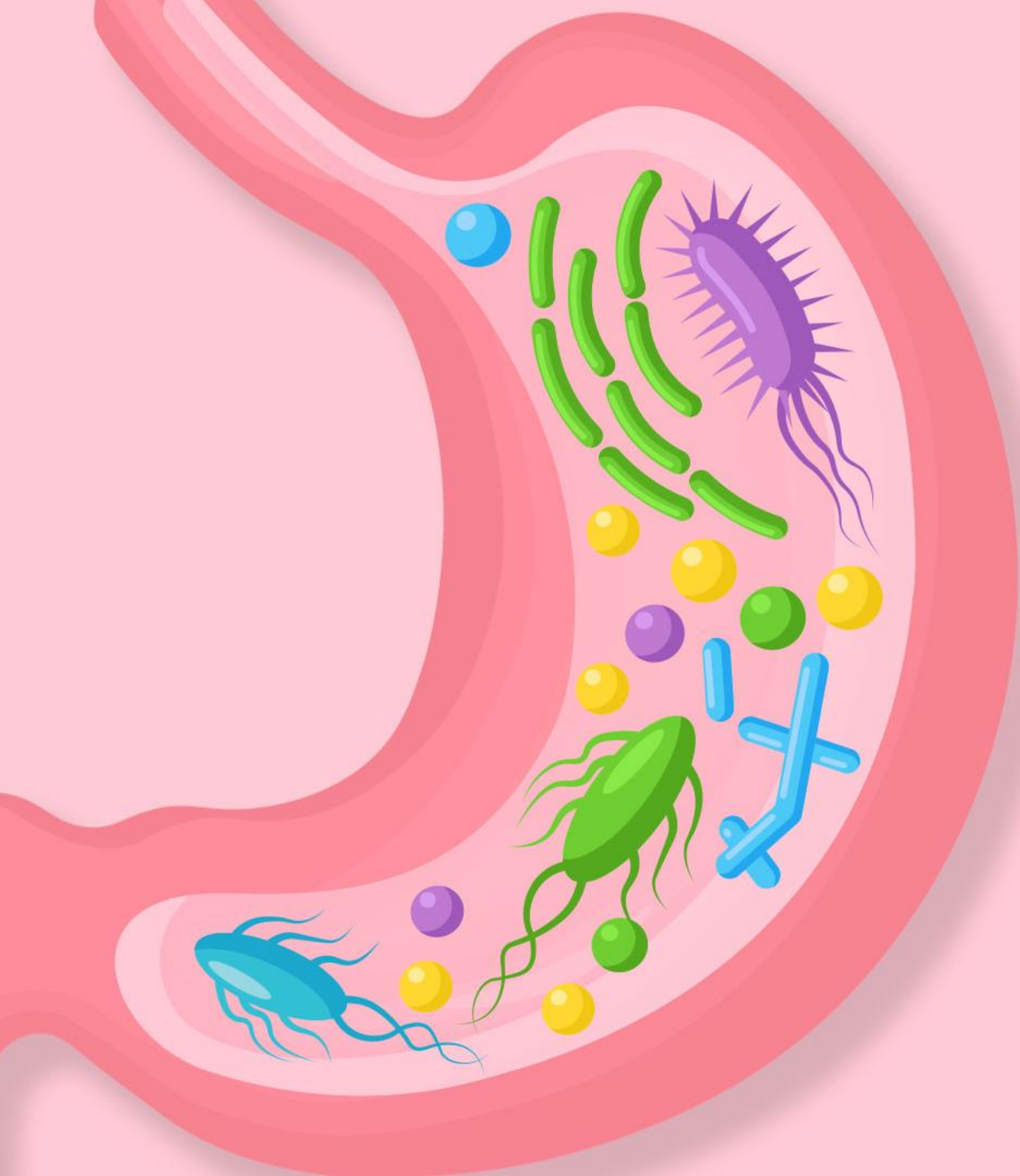




*I work with poops*

....to raise robust chickens





*Even when you are alone,  
you are not alone*



**Robust chickens**



**Which is more Resilient?**

**Snacks,  
anyone?**





# Why Insects?

**Low**

Environmental  
Impact

**High**

Nutritional  
Value



# Land Use

Why Insects? Environmental Impact | Nutritional Value



# Water Use

Why Insects? Environmental Impact | Nutritional Value



**1400L VS 3L**



# Food Waste

Why Insects? Environmental Impact | Nutritional Value

40%



# Black Soldier Fly Larvae (BSFM)

Why Insects? Environmental Impact | Nutritional Value



- 40-56% Protein
- Minerals such as calcium, phosphorus, potassium
- Chitin







**20-week trial**  
**2 \* 3 \* 2 factorial**



# Research Question

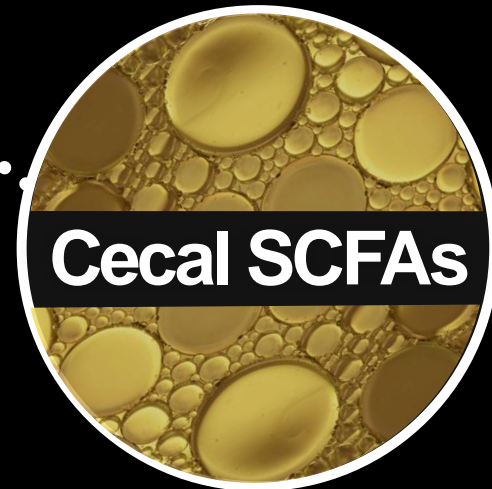
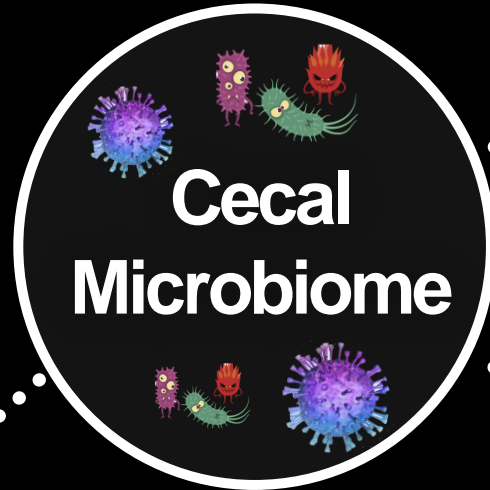
## Improved microbial resilience?





# Research Question- Improved microbial resilience?

## Results



1. Diversity of individual community



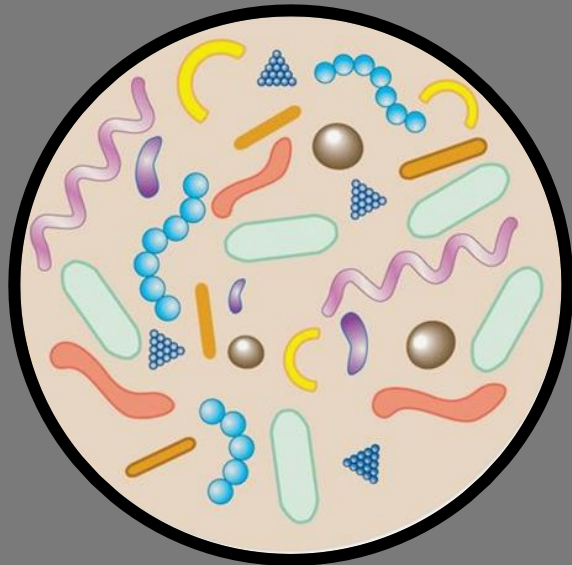
2. How do they compare?



3. Who's driving the differences?

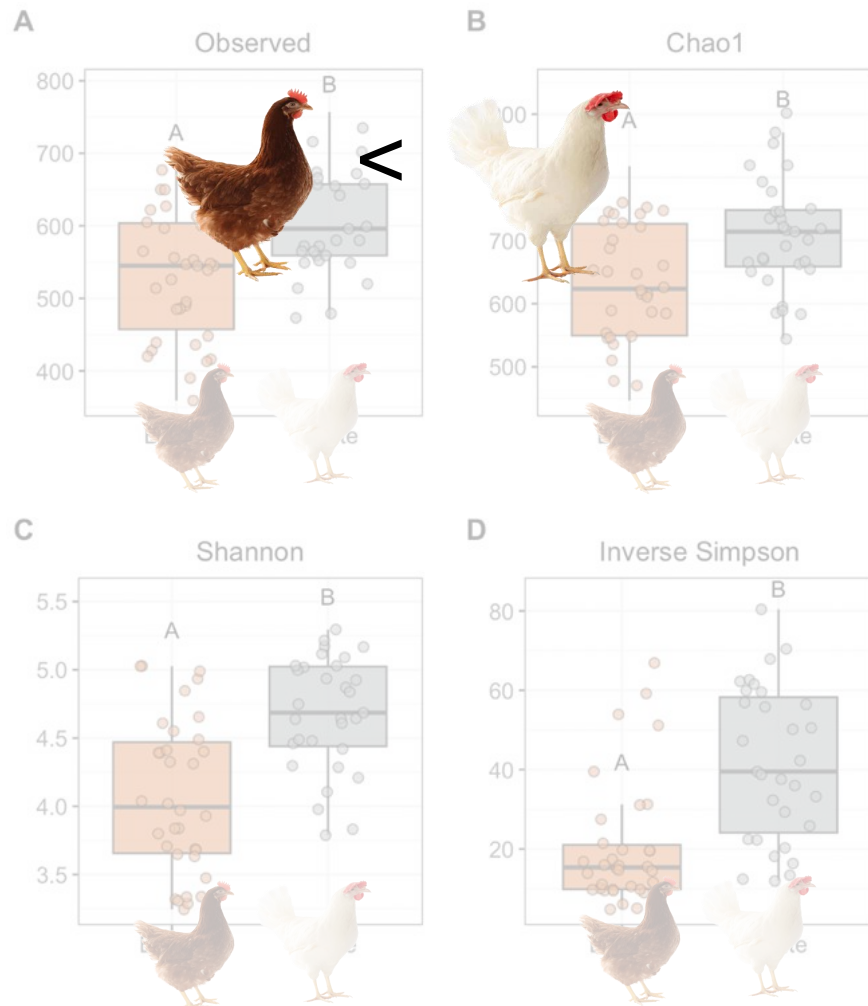
4. What were they doing?

# 1. Diversity of individual community

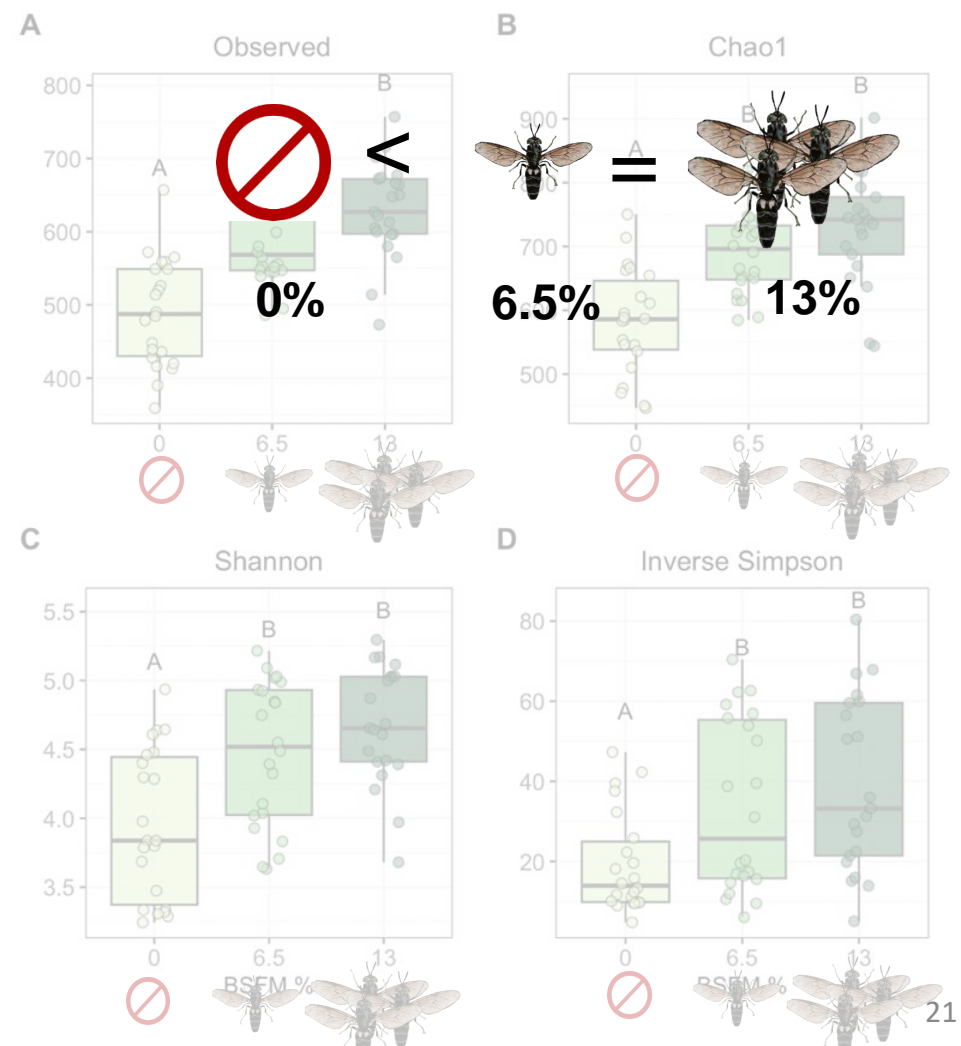


# 1. Diversity of individual cecal microbiome

By strain

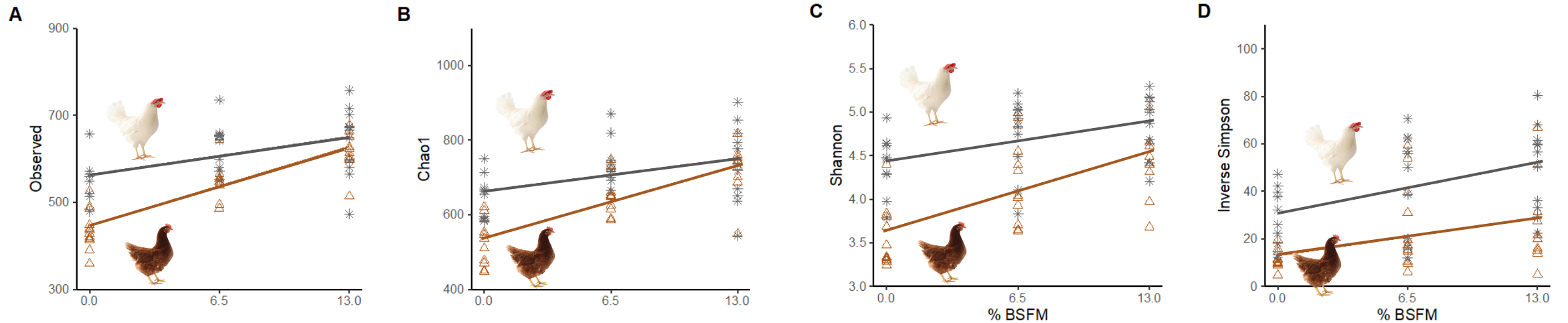


By inclusion level



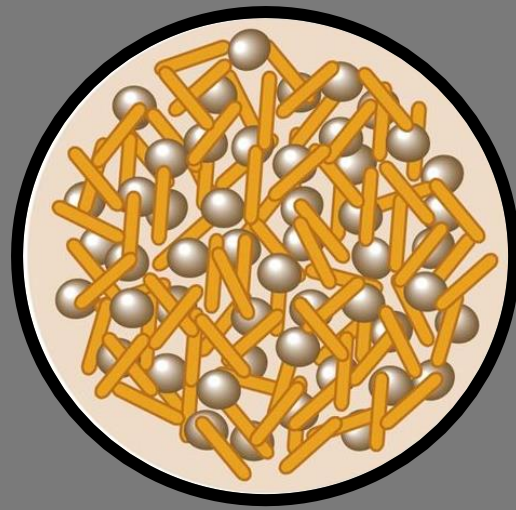
# 1. Diversity of individual cecal microbiome

## Regression of BSFM inclusion within strain (all p value < 0.05)

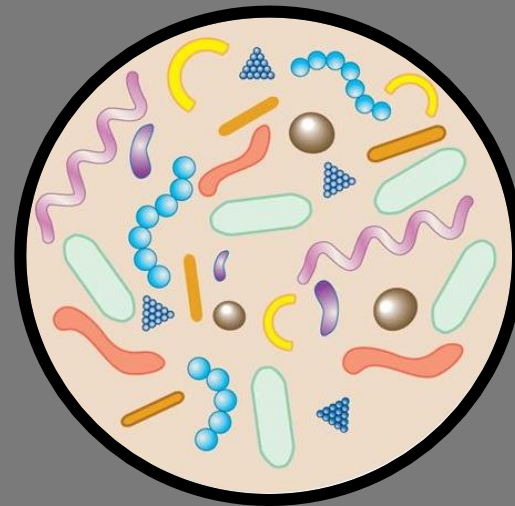


- **Within both strains, linearly increased diversity with increased %BSFM**
- **Brown has more increase than white in Observed, Chao1, and Shannon**

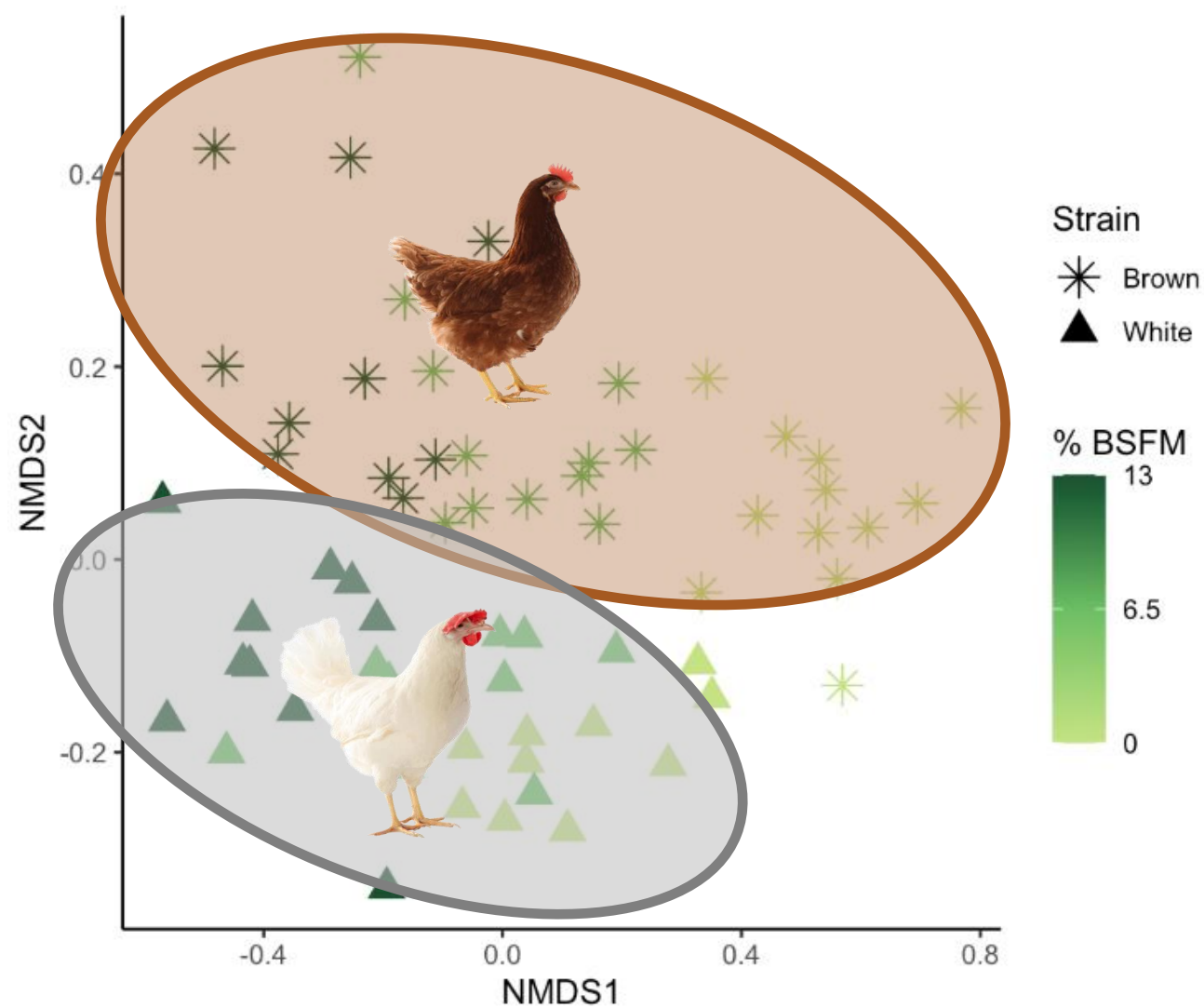
## 2. How do they compare?



VS



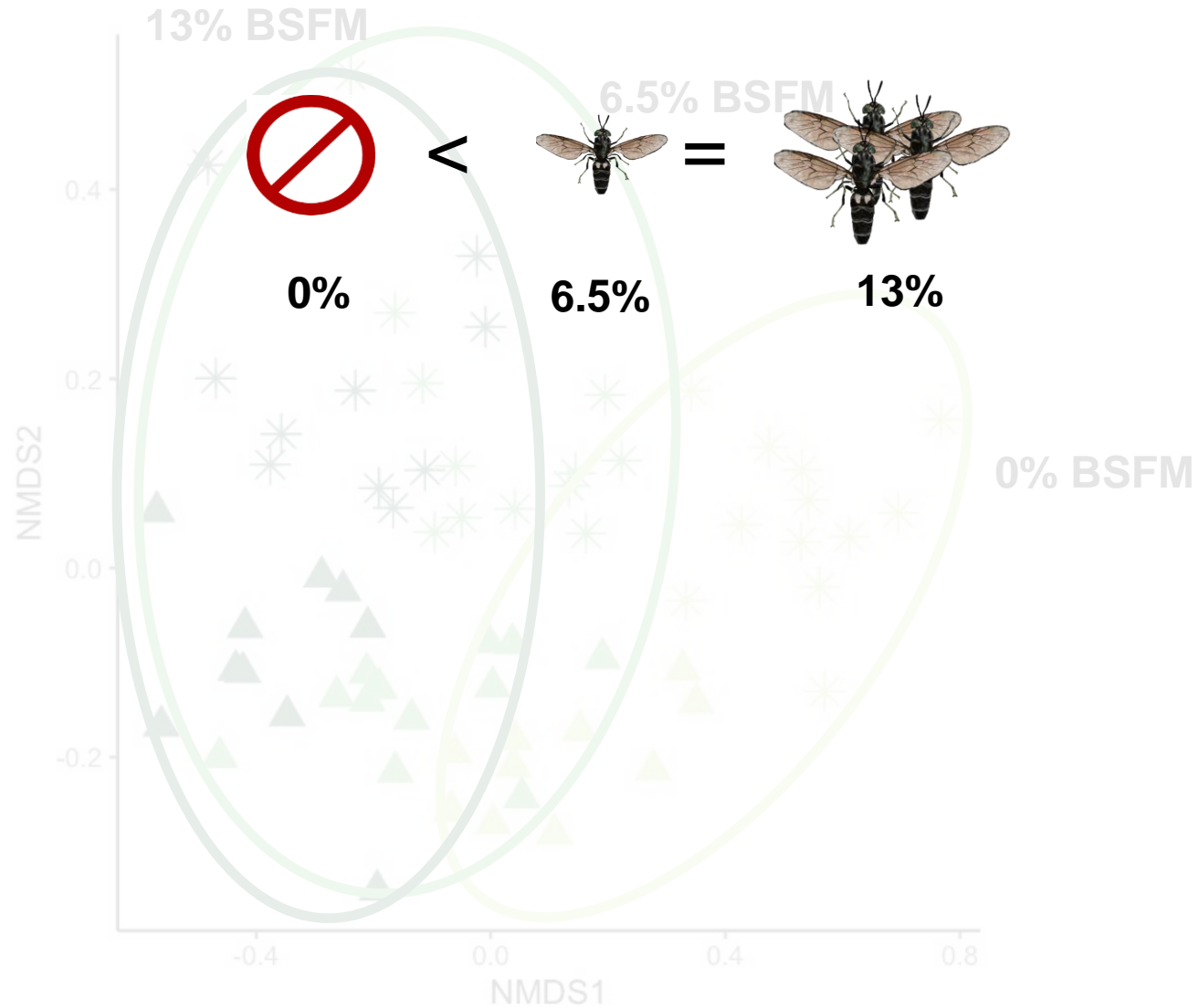
## 2. How do the cecal microbiome compare?



Stress value = 0.152  
PERMANOVA:  $p < 0.001^{**}$ ,  $R^2 = 0.139$



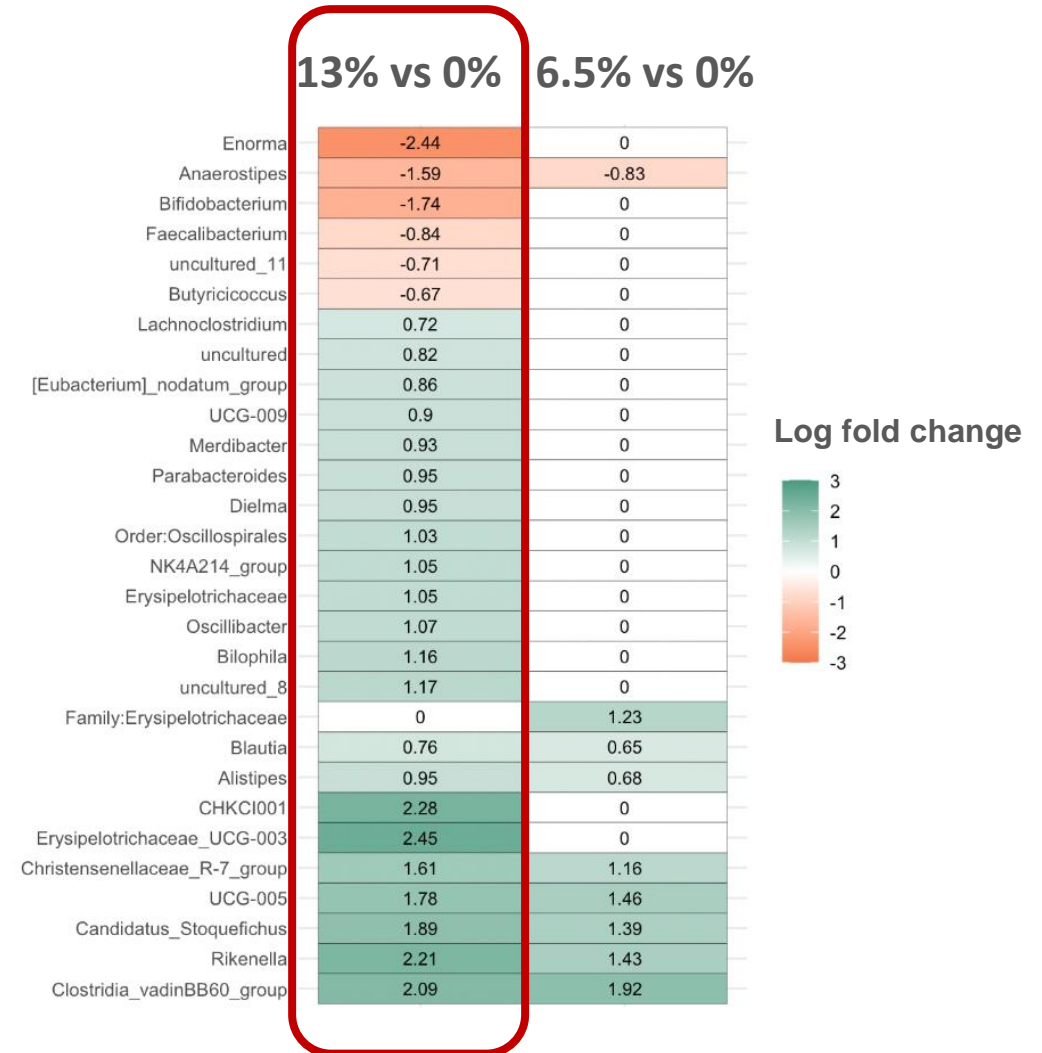
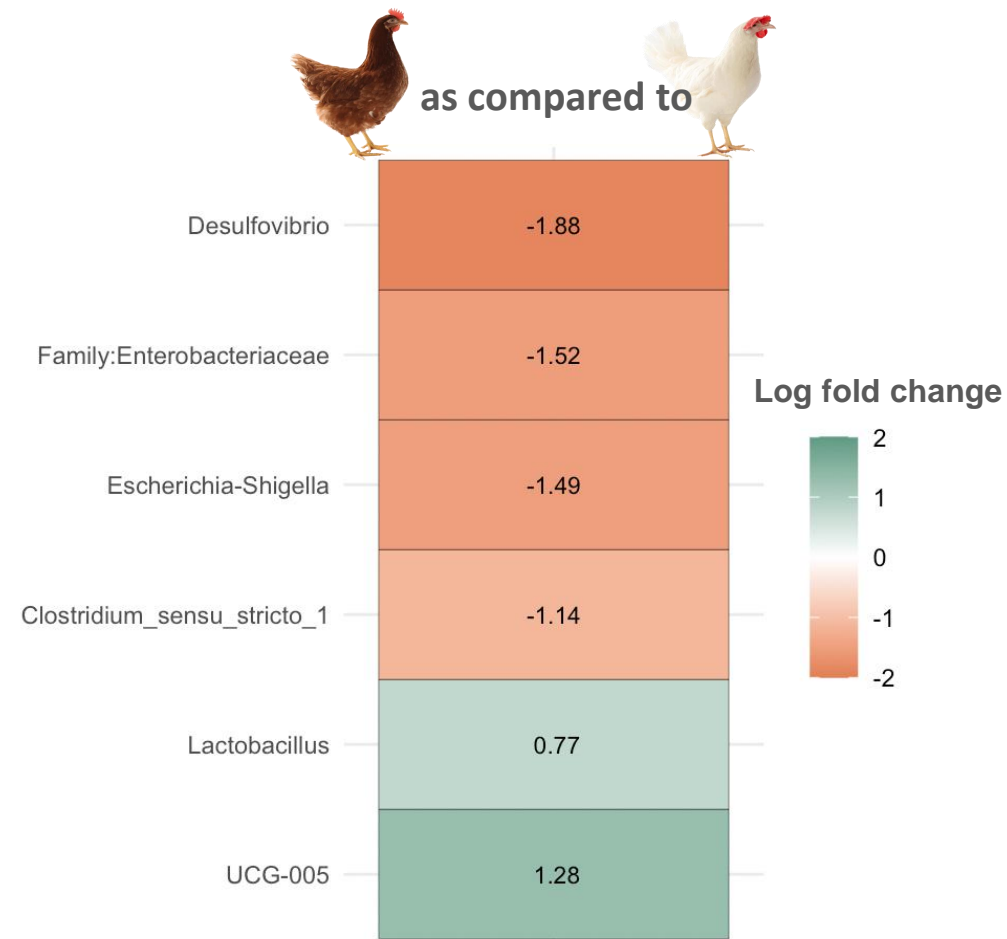
## 2. How do the cecal microbiome compare?



Stress value = 0.152  
PERMANOVA:  $p < 0.001^{**}$ ,  $R^2 = 0.113$   
Pairwise PERMANOVA, 0% < 6.5% = 13%

# **3. Who's driving the differences?**

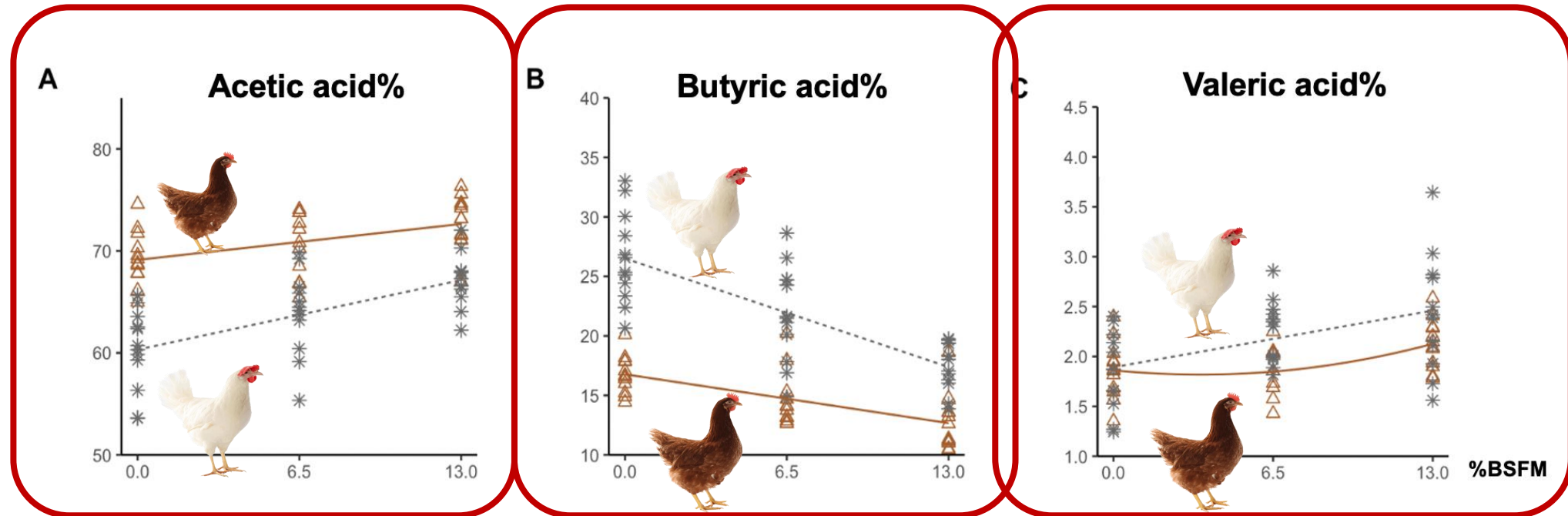
# 3. Who's driving the differences



Compositions of microbiomes with bias correction (ANCOM-BC) at the genus level

**4. What were they doing?**

## 4. What were they doing – Cecal SCFA



% BSFM had a positive linear impact on acetic acid production

% BSFM had a negative linear impact on butyric acid production

% BSFM had a positive impact on valeric acid production

- Cecal microbiome: Incorporating BSFM results in a more diverse cecal microbiome, more so in brown than white
- SCFAs: altered in both strains





**DALHOUSIE**  
UNIVERSITY

 **CANADIAN  
AGRICULTURAL  
PARTNERSHIP**  
Innovate. Grow. Prosper.

  
**NOVA SCOTIA**  

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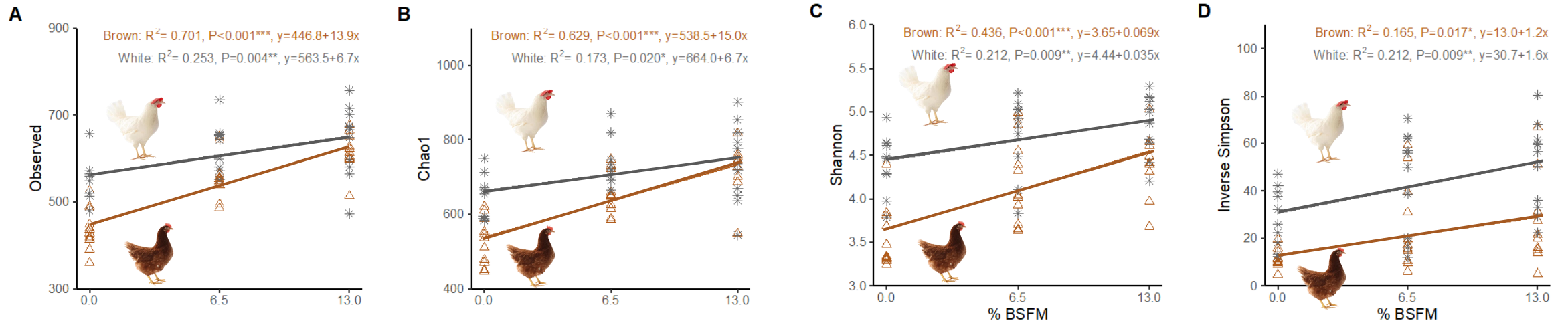
**NOUVELLE-ÉCOSSE**

**Mitacs**

 **EGG  
FARMERS**  
OF NOVA SCOTIA

*Atlantic Poultry Research Institute* 

# 1. Diversity of individual cecal microbiome





# 4. What were they doing – Cecal SCFA

