Modification of piglet behavior and welfare by dietary antibiotic alternatives

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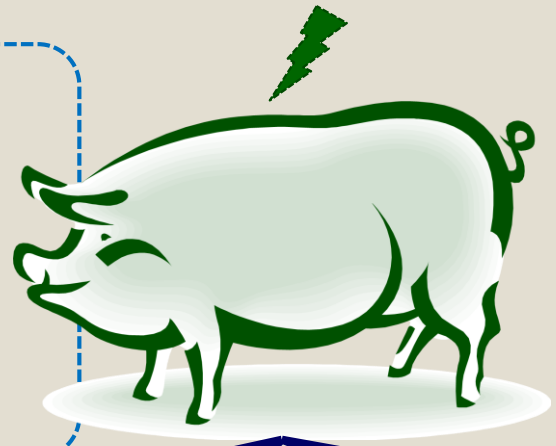
Introduction

- Pigs are subject to stress at various timepoints of production

Stressors

WEANING

- Sow separation
- Mixing
- Diet change



TRANSPORT

- Dehydration
- Feed restriction
- Temperature extremes

Emotional distress | ↑ Pathogen exposure | ↓ Intestinal health | ↓ Energy intake

➡ **Performance + Welfare issues**

(Chiba, 2010; Smith et. al., 2010; Campbell et al., 2013)

Introduction

Common practices to solve negative impact of stress:

- **Focused on performance**
- Often based on dietary **antibiotic** use - prophylactically

Societal demand for a **decrease in antibiotic use**

Antibiotic alternatives:

Bacteriophages, Probiotics, Prebiotics, Organic acids, Plant extracts, Essential oils, Lysozymes, Amino acids

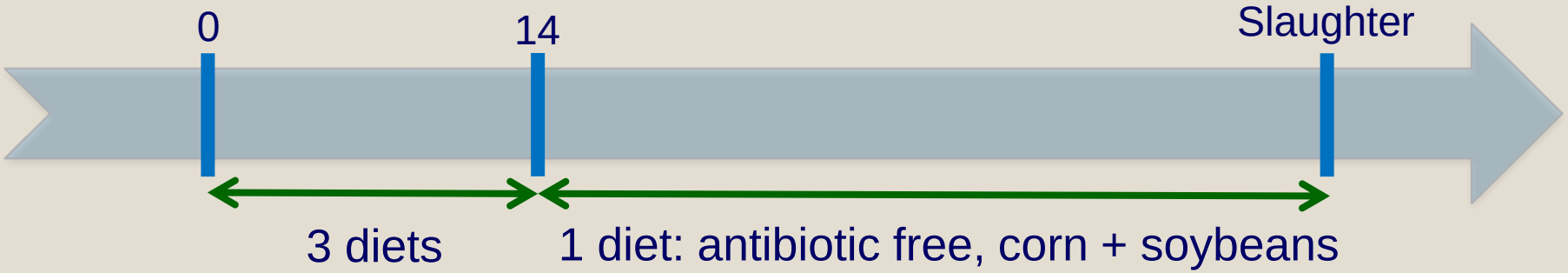
Objectives

- Study 1: Evaluate the effects of **no antibiotic (NA)**, **L-glutamine (GLN)** or **antibiotic (A)** supplementation after weaning and a transport stress on short and long-term welfare indicators and behaviors
- Study 2: Evaluate the effects of **synbiotic (SYN)** supplementation before and after weaning on cognition
- Both: Evaluate the effects of supplementation on gastro-intestinal microbial populations

Study 1: Materials & Methods

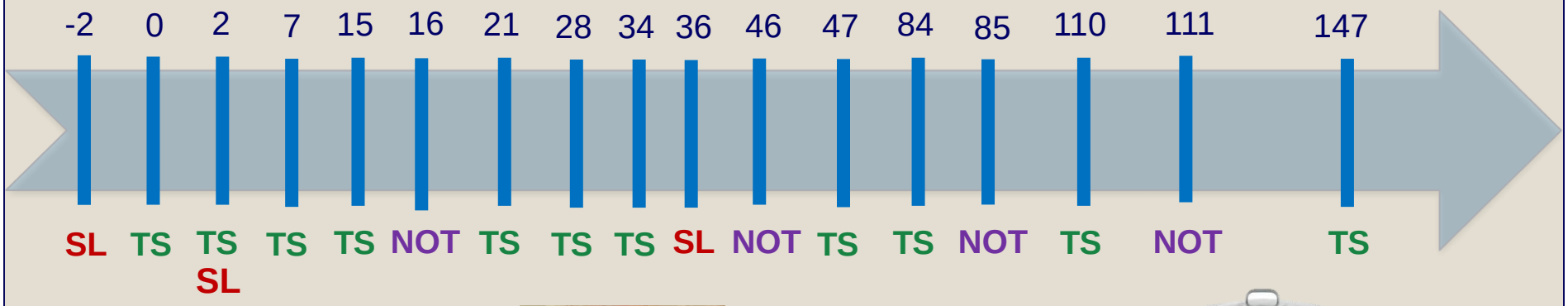
240 (Yorkshire × Landrace × Duroc) *From 32 litters, Groups of 8*

Weaning
Age: 18 ± 4.2 days
Weight: 5.4± 1.4 kg
+ 12h-Transport



1. **A** – Antibiotic diet: Chlortetracycline (0.40g/kg) + Tiamulin (0.035g/kg)
2. **NA** – Control diet: without any antibiotic or feed supplement
3. **GLN** – L-glutamine diet: 0.20% L-glutamine

Study 1: Materials & Methods



TS – Tear staining (indicator of stress)

SL – Skin lesions (indicator of aggression)

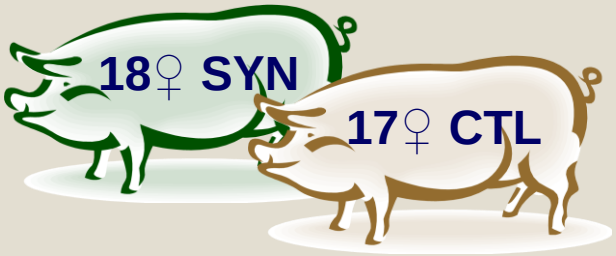
NOT – Novel object test in home pen

Avoidance

Showing interest

Interacting

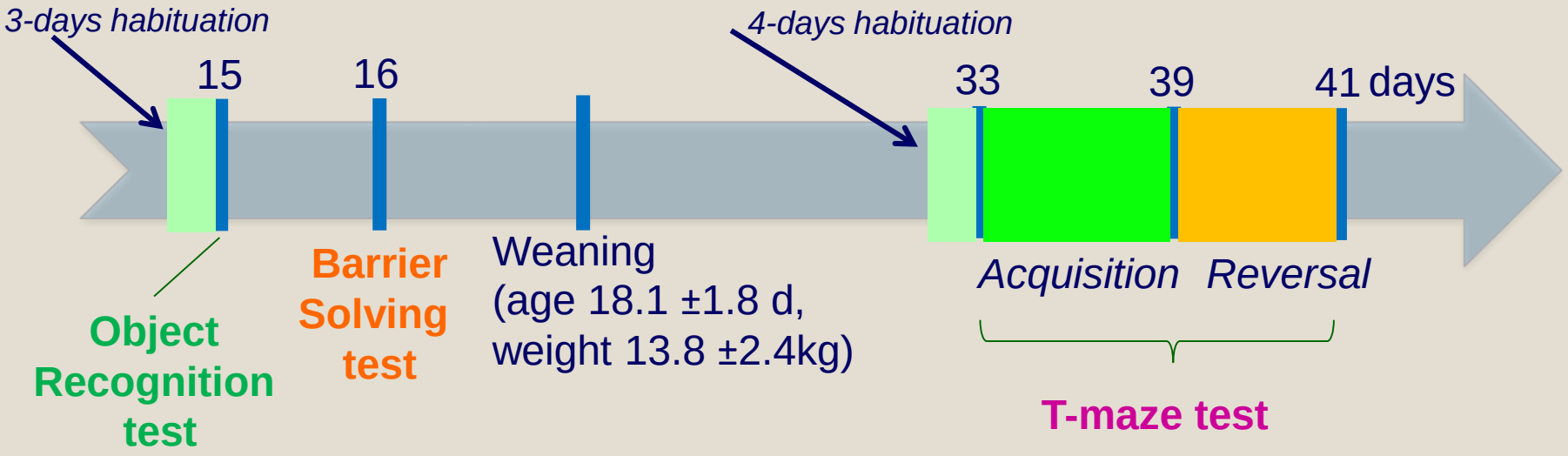
Study 2: Materials & Methods



(Landrace × York)

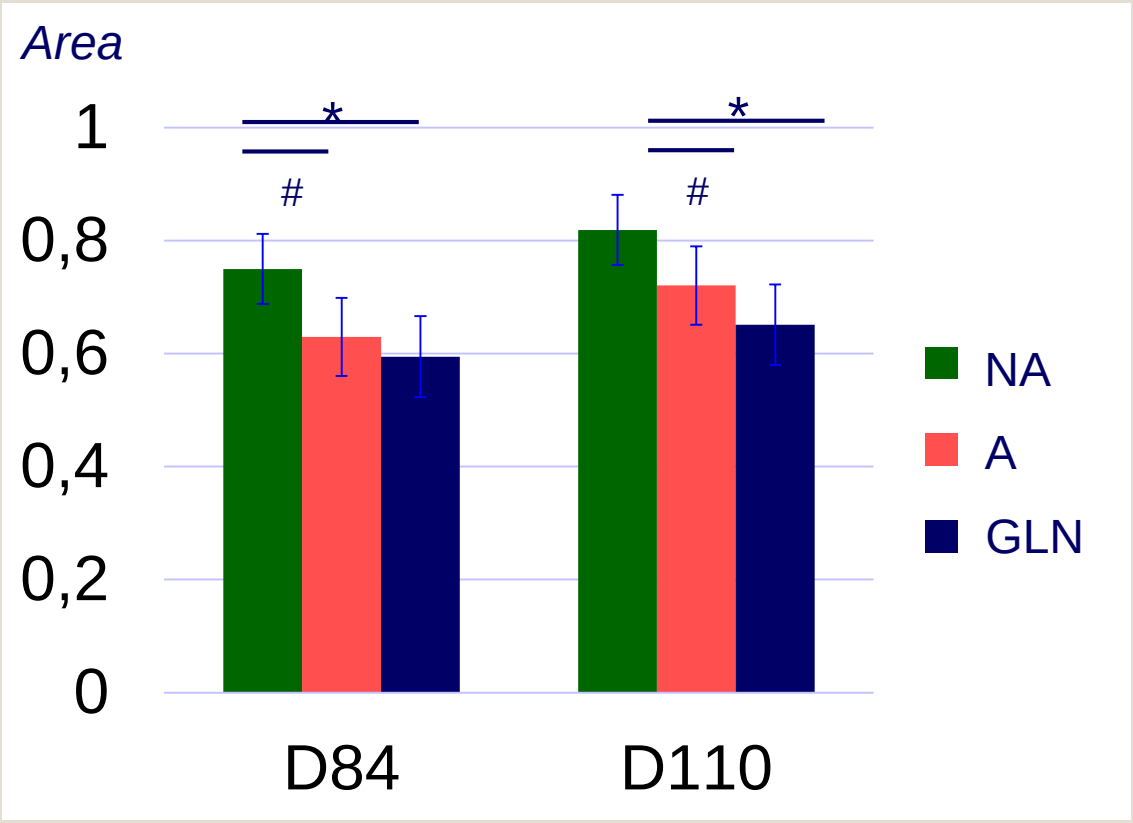
From **1 to 28 days of age**, individual feed supplementation by oral dosing:

1. **SYN** - Synbiotic supplement: a probiotic (*Lactobacillus)* + a prebiotic (fructo-oligosaccharide) + *Saccharomyces cerevisiae* cell wall
2. **CTL -** Control supplement: chocolate milk



Study 1: Results & Discussion

Tear Stains



Larger stain areas for NA pigs = Long-term effects of a short diet treatment

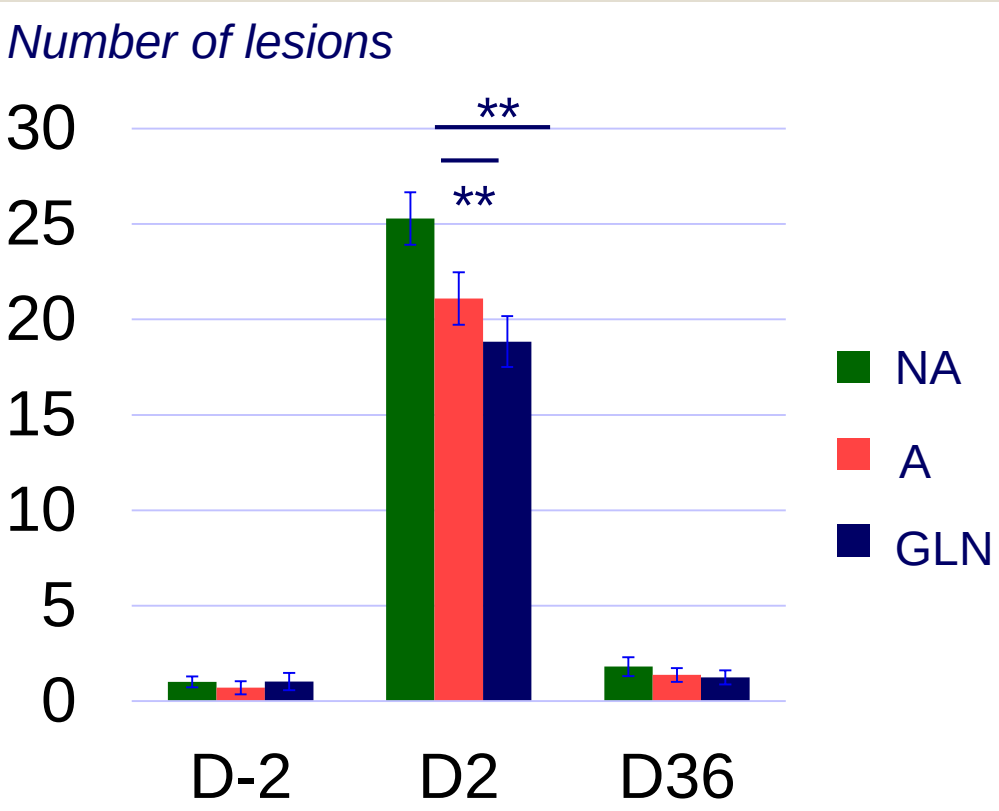
NA pigs more stressed

GLN pigs similar to **A** pigs

# p<0.1 * p<0.05

Study 1: Results & Discussion

Skin Lesions



Effects only on Day 2
= the establishment of the hierarchy post-mixing

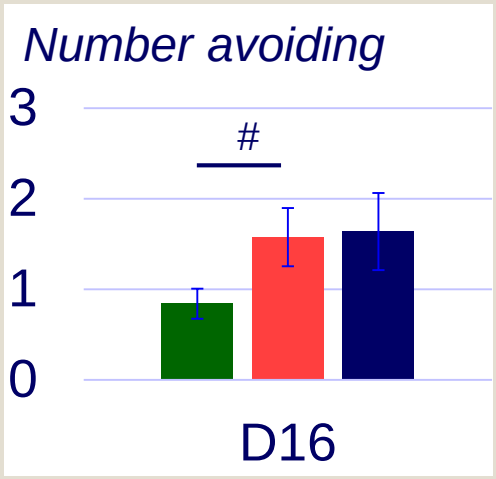
NA pigs had more lesions than **A** and **GLN** pigs
→More aggression

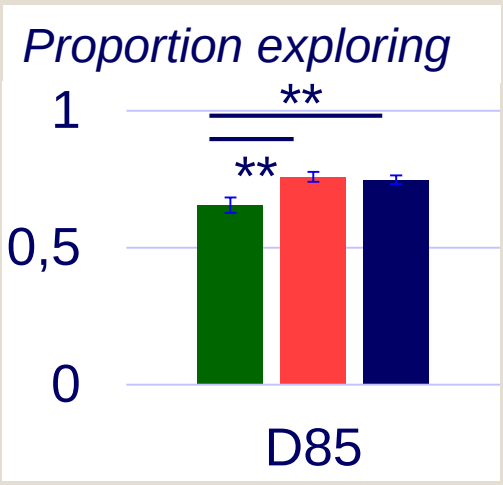
GLN pigs similar to **A** pigs

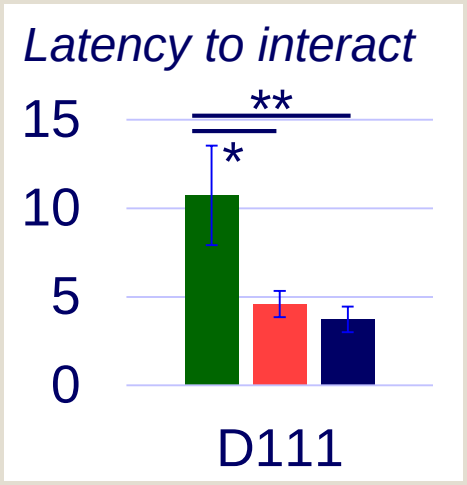
** p<0.01

Study 1: Results & Discussion

Novel Object Tests







Short and long-term effects of a short diet treatment

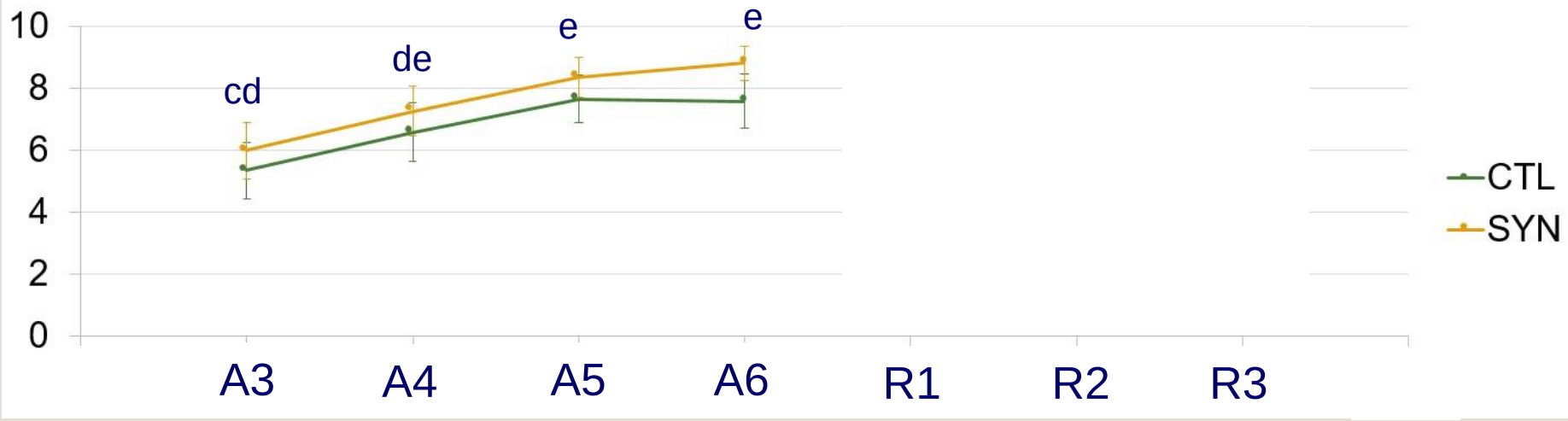
NA pigs less interested by the object → less avoiding but less time exploring
+ slower to interact

# p<0.1 * p<0.05 **p<0.01

Study 2: Results & Discussion

T-maze Test

Number of correct choices



- **SYN** piglets interacted quicker with the novel object in the OR Test - EPISODIC-LIKE MEMORY
- **SYN** piglets had shorter distances to finish the test in BS Test - WORKING MEMORY
- **SYN** piglets were quicker to learn in TM Test - SPATIAL MEMORY
- **SYN** piglets tried the new rewarded arm earlier in the TM Test - REFERENCE MEMORY

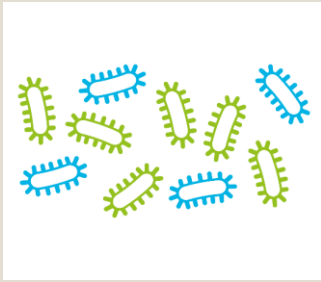
Conclusions

- Short-term feeding strategy (2 or 4 weeks) can have both short- and long-term effects
- **Study 1: NA** pigs appeared less interested by novel objects and more sensitive to environment and management than **A** and **GLN**
- L-glutamine appeared to confer similar benefits to, and thus could be a viable alternative to dietary antibiotics
- **Study 2:** The synbiotic supplement may **confer memory advantages in the 3 cognitive tasks**, regardless of the nature of the reward and the memory request.
- Beneficial effects occurred both **before** and **after weaning**

Preliminary Results

Study 1:

- Differences in microbiota between treatments at end of 14d feeding period.
- No differences 3 weeks later

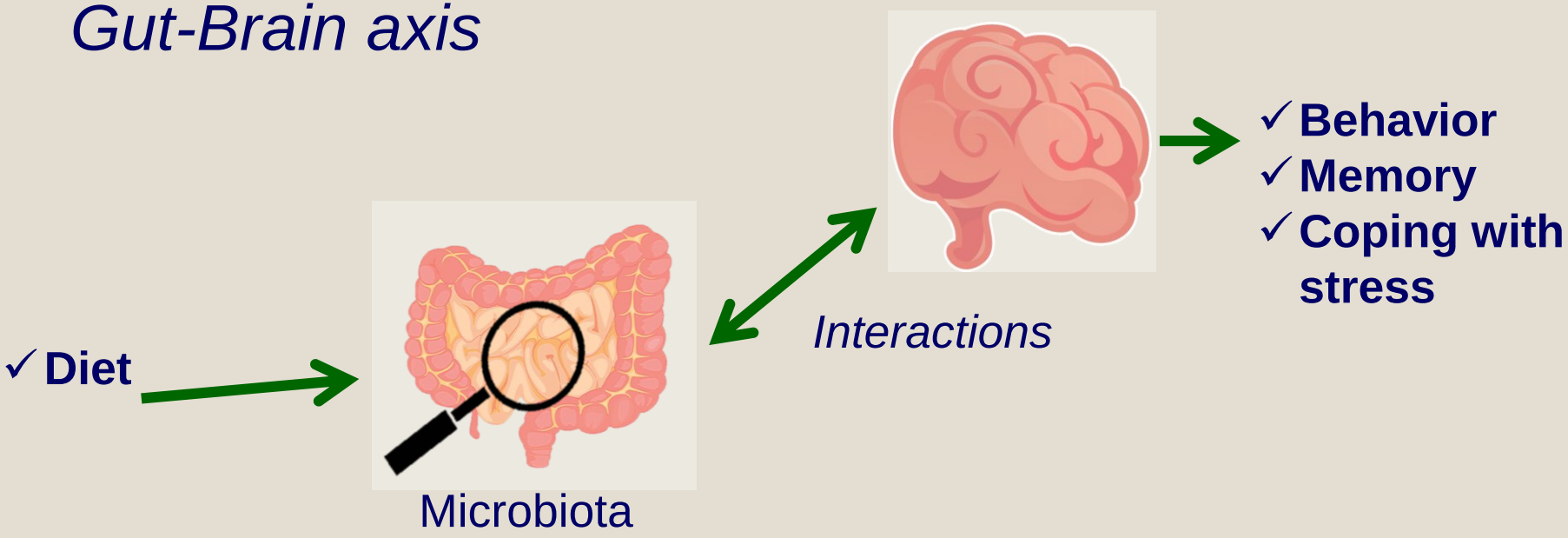


Study 2:

- No differences in microbiota between treatments at d14
- Tendency at d33 ($P<0.066$)
- Different at d39 ($P<0.044$)
- Suggests we may have long-term impact on microbiota if we dose early

Untapped Potential

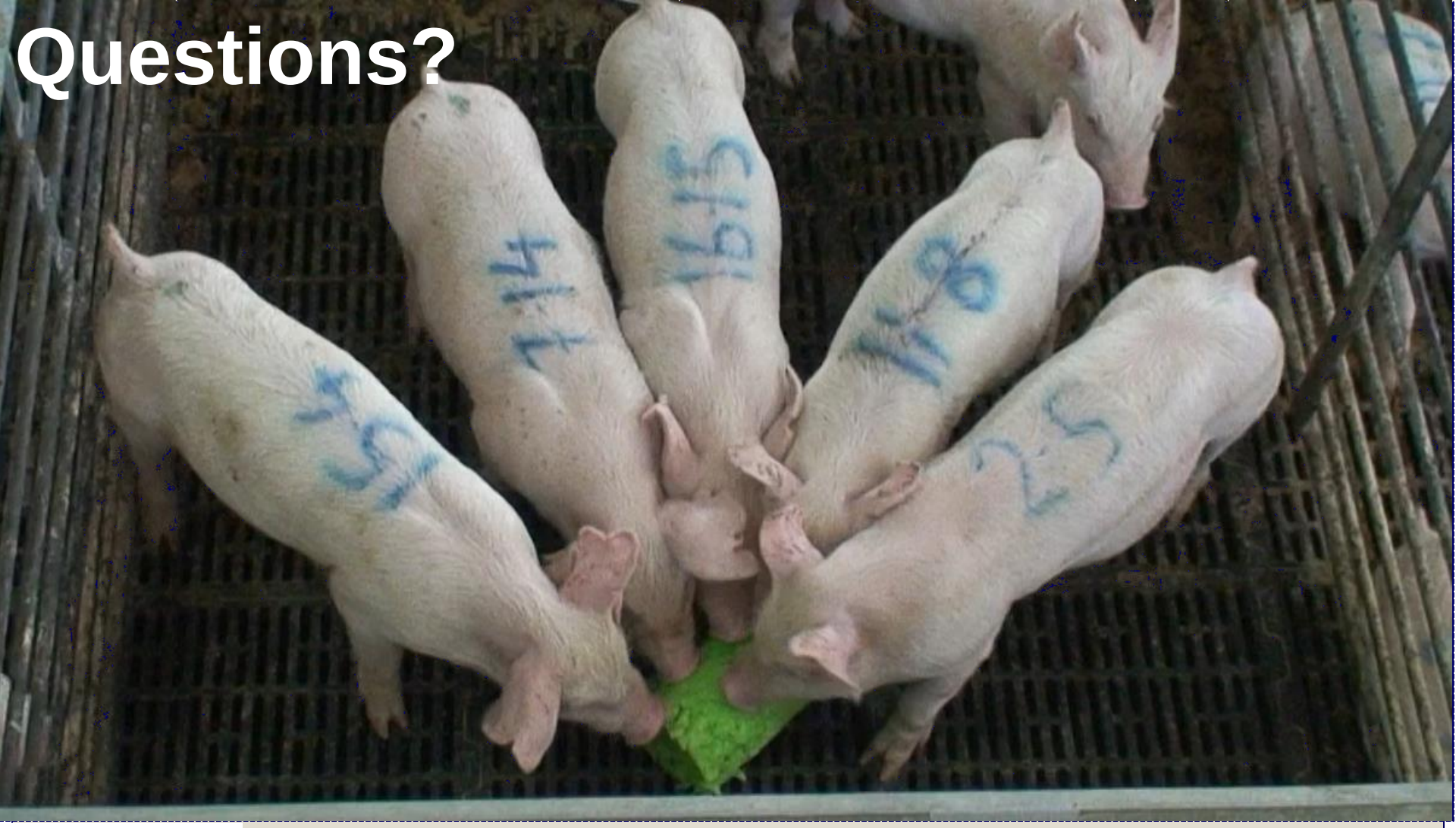
Gut-Brain axis



"the relationship between diet and the microbiota-gut-brain axis is ripe for exploitation to develop therapeutic strategies for treating stress-related disorders"

Foster et al. (2017) Stress & the gut-brain axis: Regulation by the microbiome. *Neurobiology of Stress*, **7:**124-136

Questions?



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