

NUTRITIONAL INTERVENTIONS FOR REDUCED PARASITE LOAD IN ORGANIC CHICKENS

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BACKGROUND

Ban on the conventional cages for layers in the EU

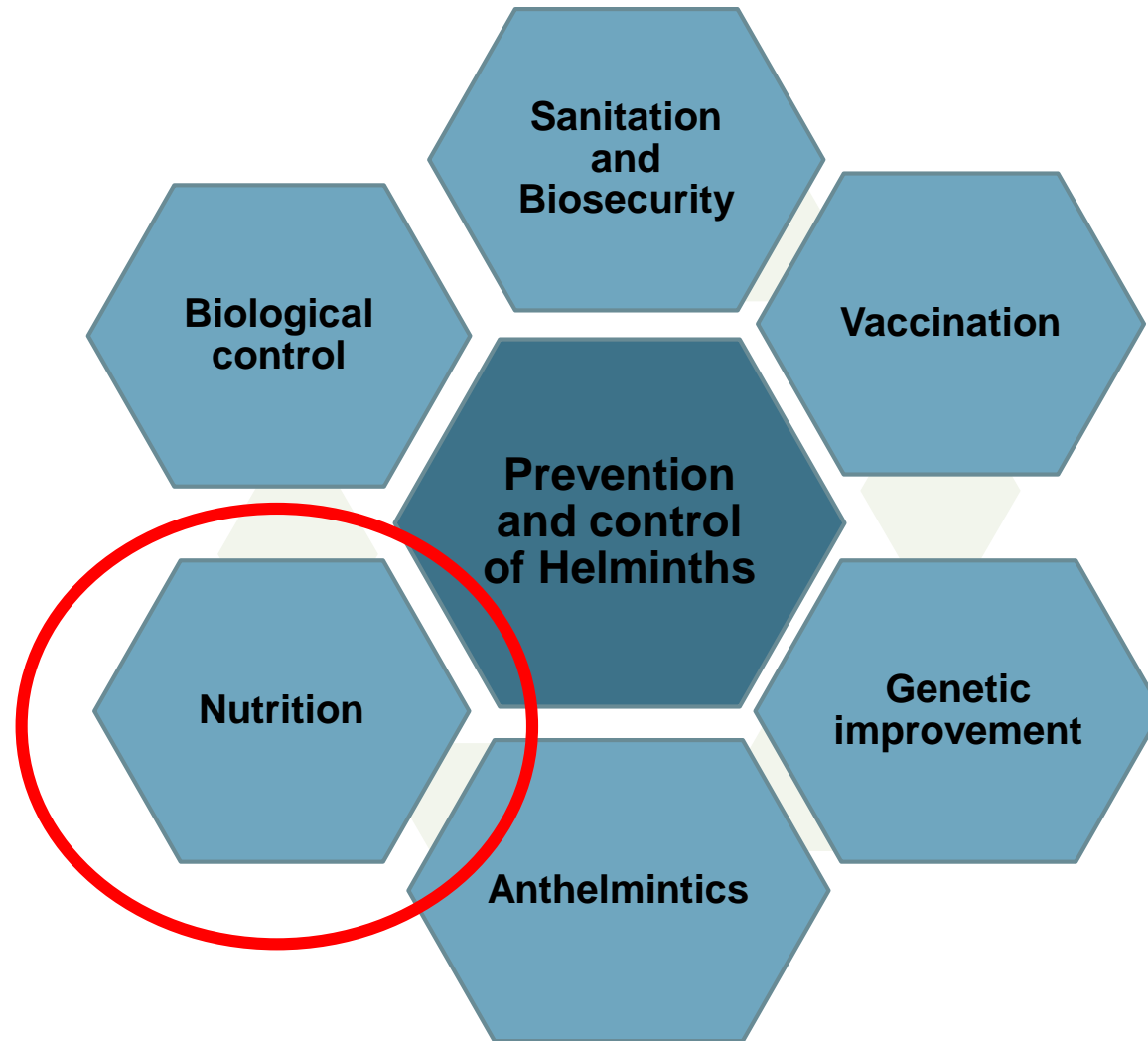
Alternative housing system

floor, deep-litter, free-range

Organic egg production

Increasing incidence of helminth infection





STUDY OBJECTIVES

Development of strategies to limit parasite infection through feeding (roughage, free-range plant-based nutrition, plant extracts) and management strategies (optimal planting of vegetation on outdoor areas) to improve health and welfare of hens and pigs in organic outdoor systems

Infection trials with layers to study the specific effect of different plant material on the incidence of parasite infections and effect on microbiology and immune parameters

-> at AU we have established an *A. galli* infection model – used to study the effect of the diet on the possibility to reduce the incidence of intestinal parasite infections and support gastrointestinal health and bird welfare

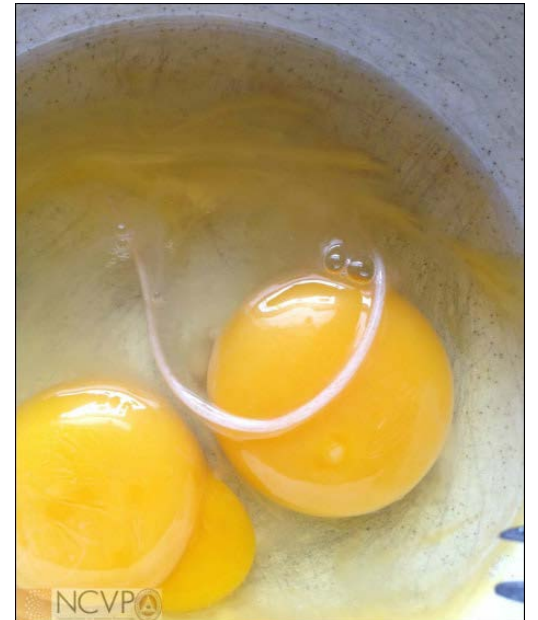
ASCARIDIA GALLI

- *Ascaridia galli*: gastrointestinal nematode found in chickens, pheasants, partridges and wild birds
 - Infections via contaminated feed/water/environment
 - Infections are common in deep litter and free-range flocks
 - Male up to 10 cm long and females up to 14 cm long. 4-5 mm thick

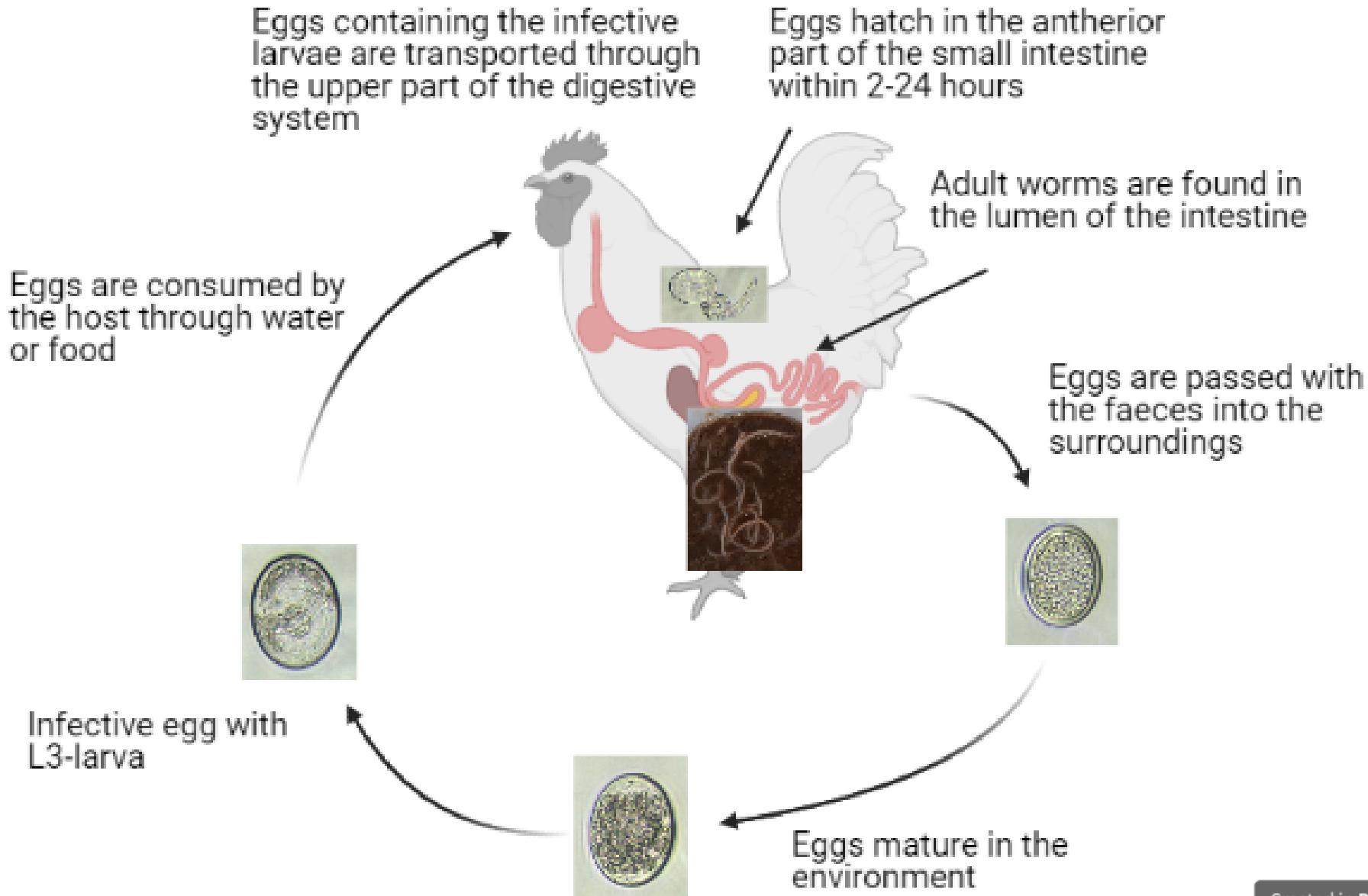


ASCARIDIA GALLI

- Clinical symptoms: weight loss, anorexia, diarrhoea, enteritis, obstruction of lumen, death
- Effect on egg-production: 20% reduction (depending on severity)
- Egg invasion potential
- Increased feed intake and decreased feed conversion ratio
- 7-10 adult worms in the gut -> enough to induce significant changes
- Suggested that *A. galli* has an immune suppressive effect on the host

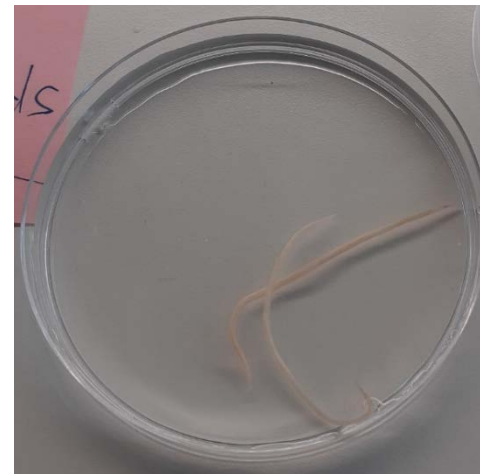


A. GALLI LIFECYCLE



IN VIVO LAYER EXPERIMENT – FERMENTED FEED ADDITIVE AND *A. GALLI* CHALLENGE

- *Feed B: a fermented product based on rapeseed meal and seaweed.*
 - *Contains antibacterial and anti-inflammatory compounds.*
 - *Shown to have potential beneficial effects on intestinal health in monogastric animals*
- **Preliminary results** on performance and immunological profiles



EXPERIMENTAL OUTLINE AND SAMPLING



Infection with *A. galli* eggs



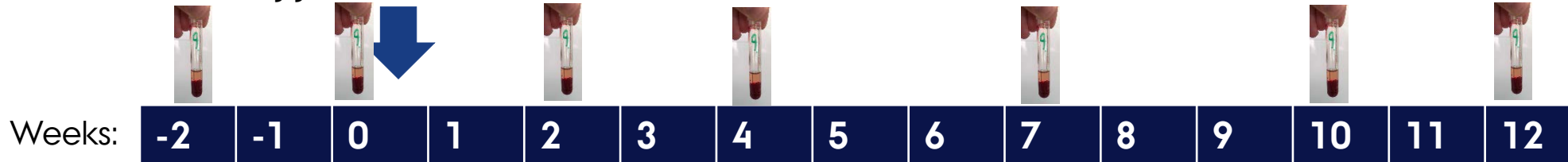
750 *in vitro* embryonated *A. galli* eggs i.t. or "natural" exposure to pre-deworming litter



Faecal samples



Blood samples



18 week old commercial layers
Deworming and start of feed addition

Termination
Intestinal content
and tissues

MATERIAL AND METHODS

48 hens pr. treatment with 6 hens pr. pen (192 hens in total)

Performance: Egg production, weight gain, feed intake

Gut health: Dry matter of faeces, faecal pH, short chain fatty acids, plasma colouration, (serum D-lactate)

Parasitology: EPG, worm burden, *A. galli* specific IgY in serum

Immunocompetence: Differential leucocyte counts, mitogen response of lymphocytes, phenotype of intraepithelial lymphocytes, Ig production potential in gut mucosa

Treatment	Feed	Group name
Challenge infected	Control (A)	A Inf
Challenge infected	Feed B 6%	B Inf
Naturally infected	Control (A)	A non
Naturally infected	Feed B 6%	B non



EGG PRODUCTION

Infection with *A. galli* eggs



Age of hens (weeks):

20

21

22

23

24

25

26

27

28

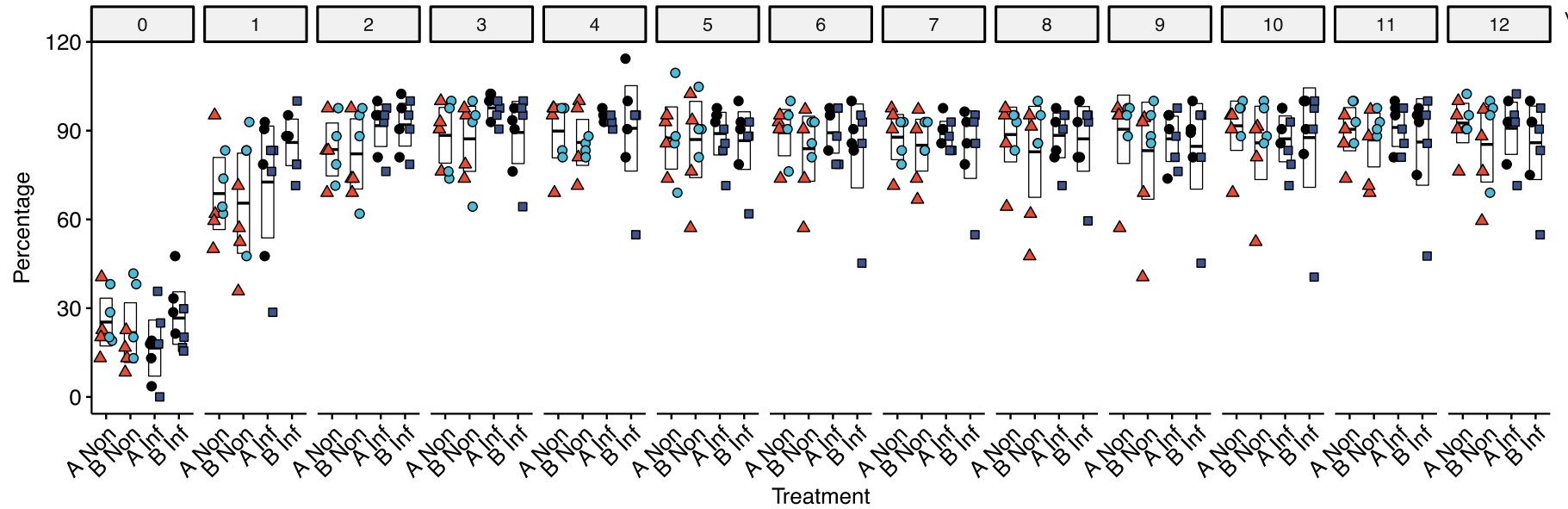
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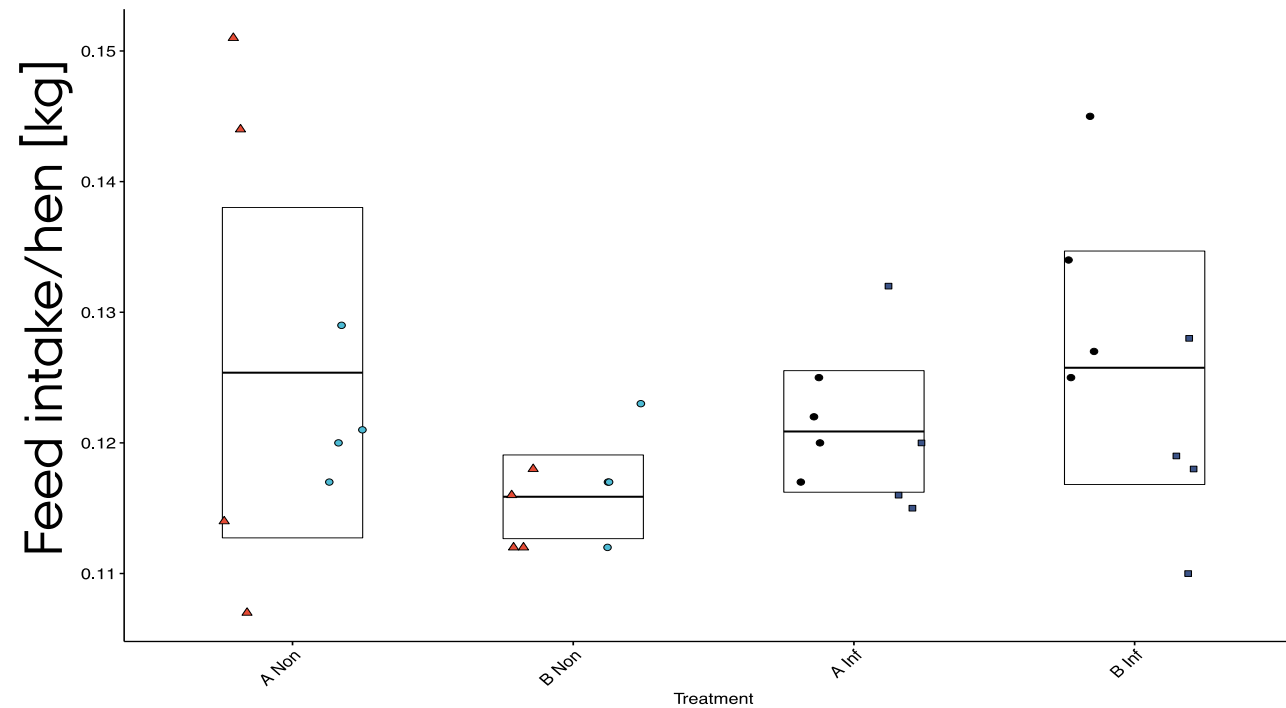
Weeks p.i.



FEED INTAKE



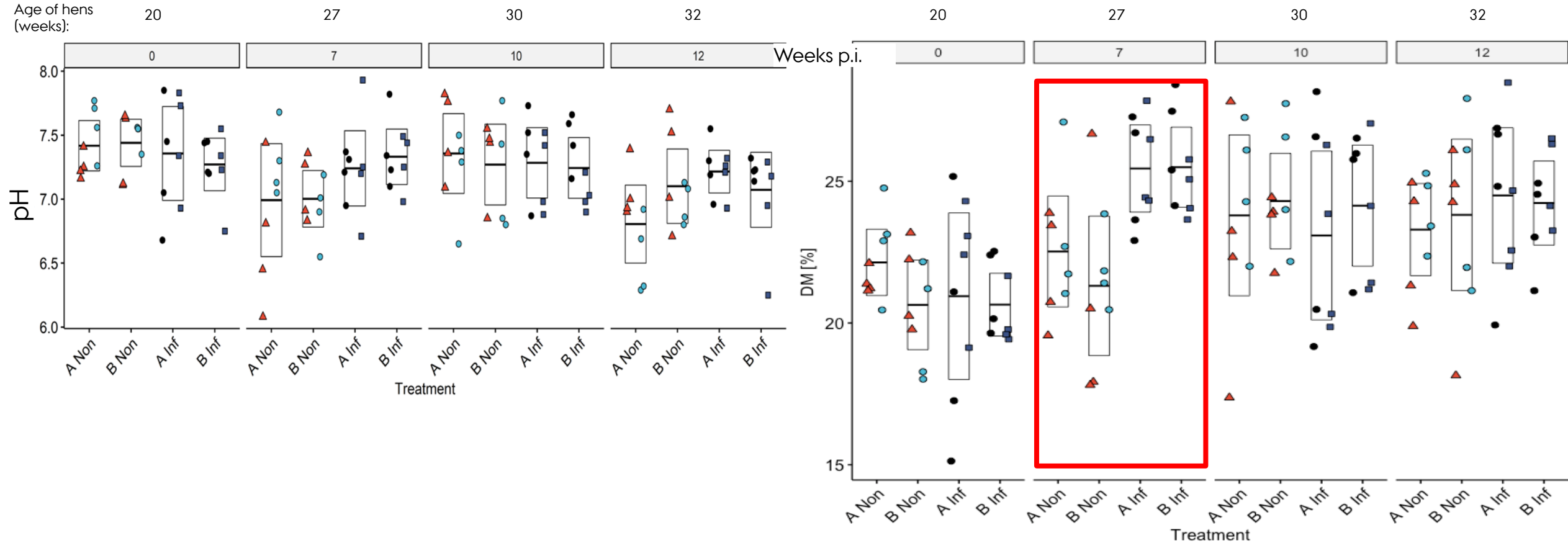
Average daily feed intake



FAECES:

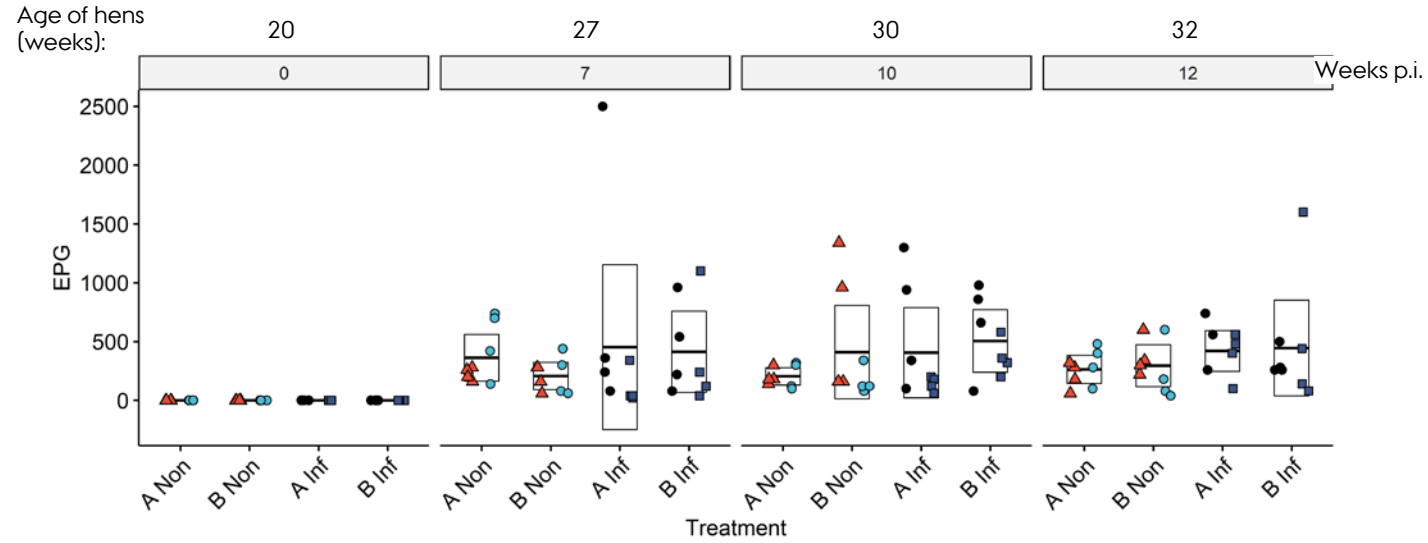
pH

Dry matter content

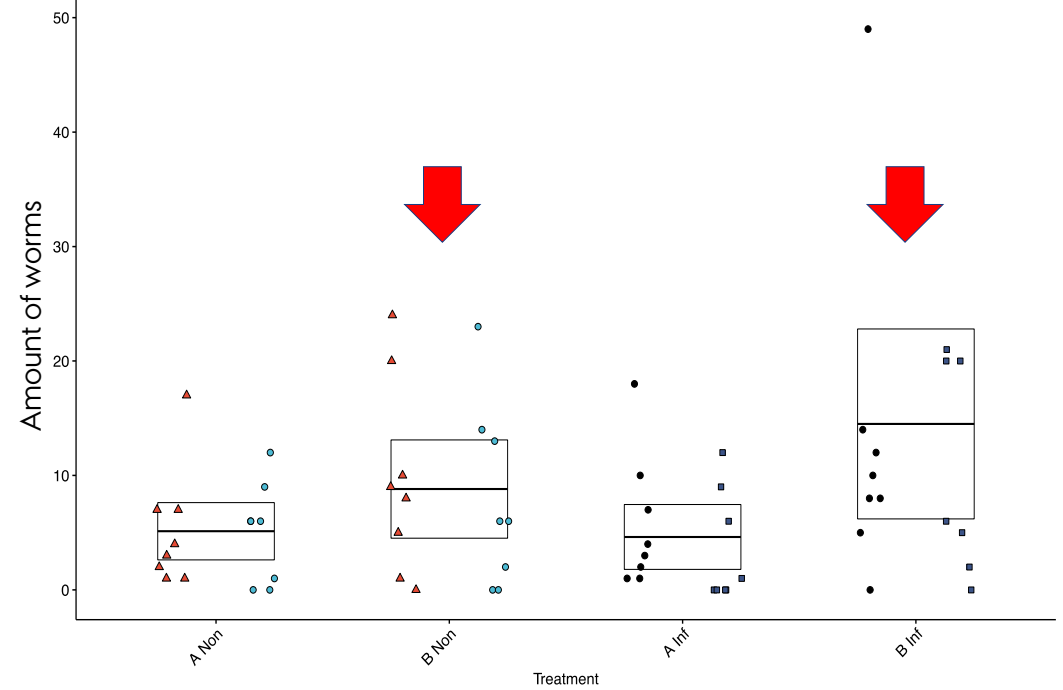


EPG AND WORM BURDEN

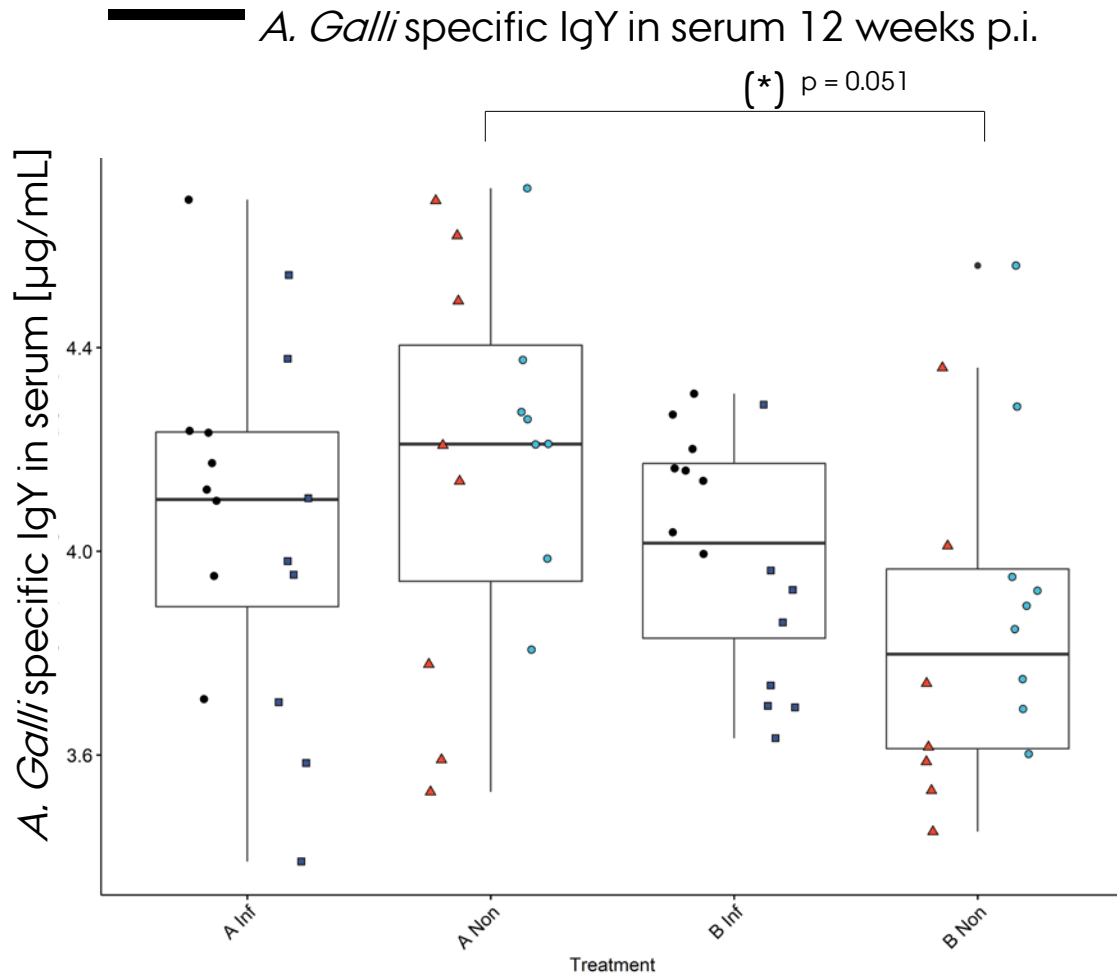
A. galli eggs per gram faeces (EPG)



Parasite load week 12 p.i.

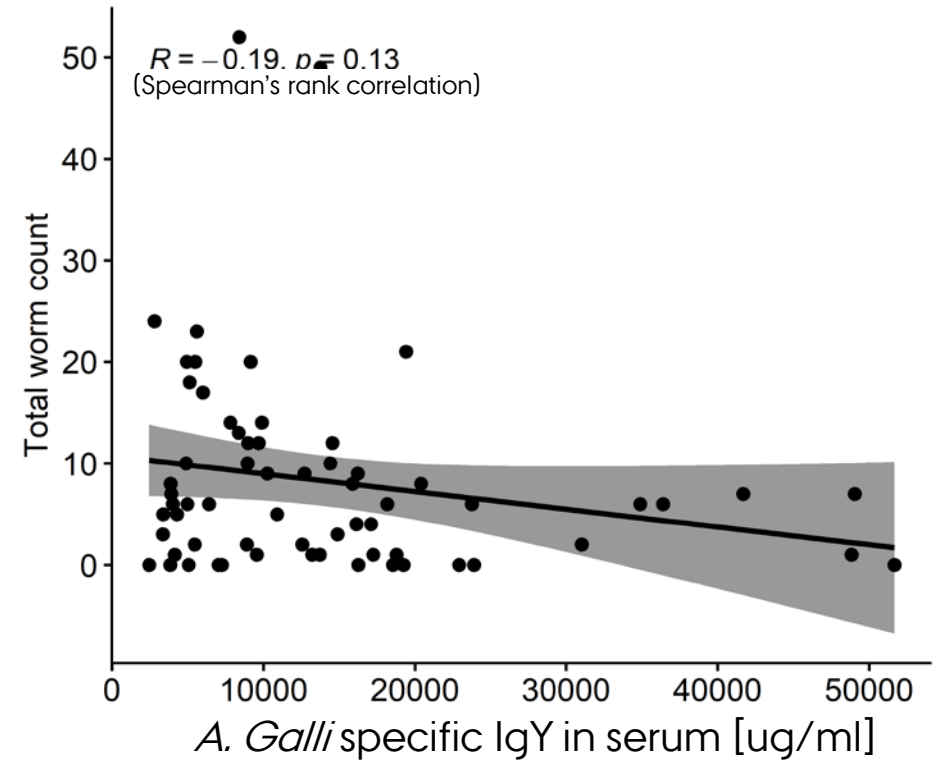


A. GALLI/SPECIFIC IgY (SERUM)

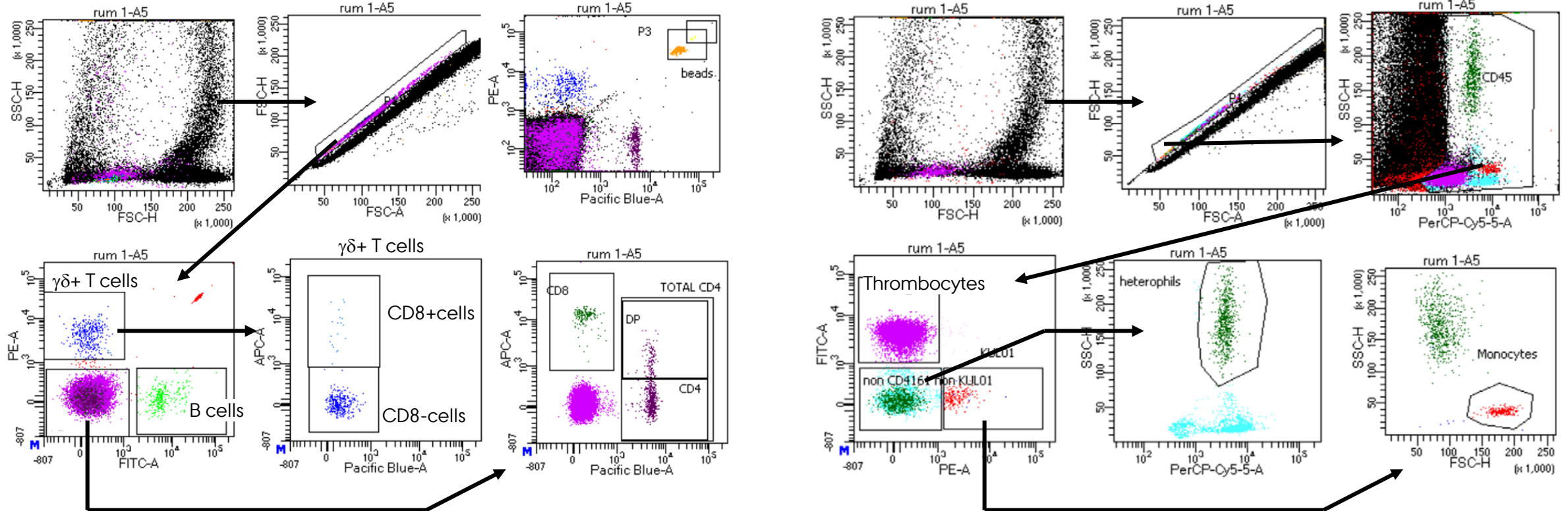


Inverse correlation between systemic IgY level and worm count?

Not statistically significant

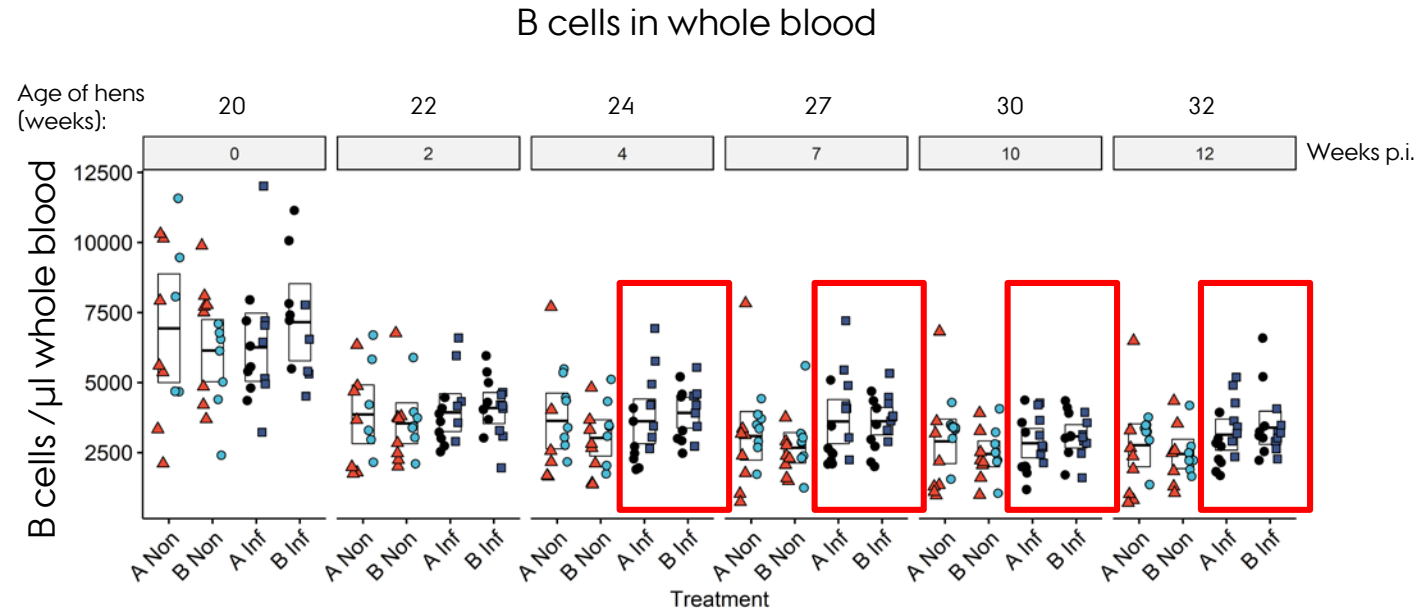


DIFFERENTIAL LEUKOCYTE COUNTS

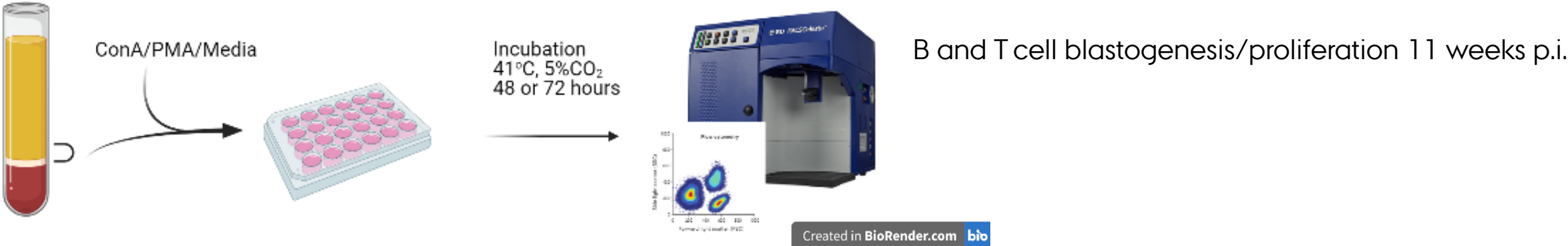


DIFFERENTIAL LEUKOCYTE COUNTS

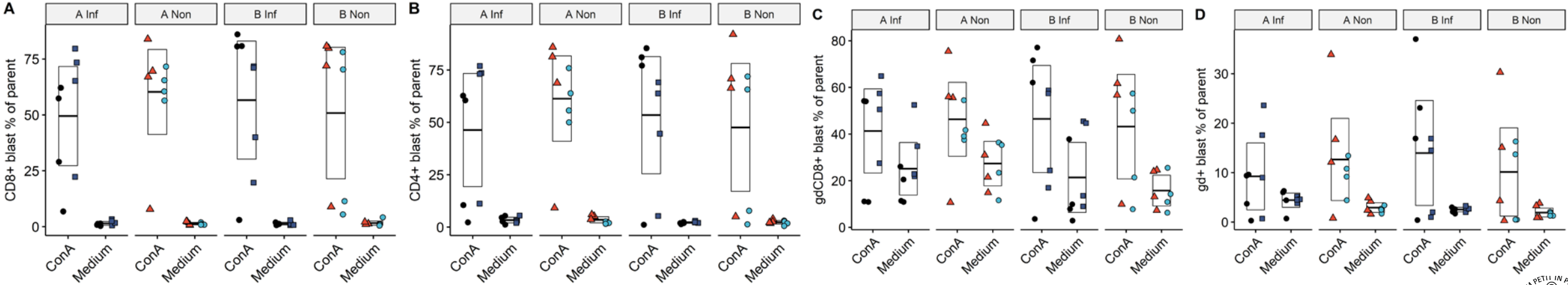
- Monocytes
- Thrombocytes
- Heterophils
- B cells
- T cells
 - $\gamma\delta$ CD8-
 - $\gamma\delta$ CD8+
 - $\alpha\beta$ CD8+
 - $\alpha\beta$ CD4+
 - $\alpha\beta$ CD4+CD8+
- Heterophil-Lymphocyte ratio
- CD4-CD8 ratio



MITOGEN RESPONSE OF LYMPHOCYTES



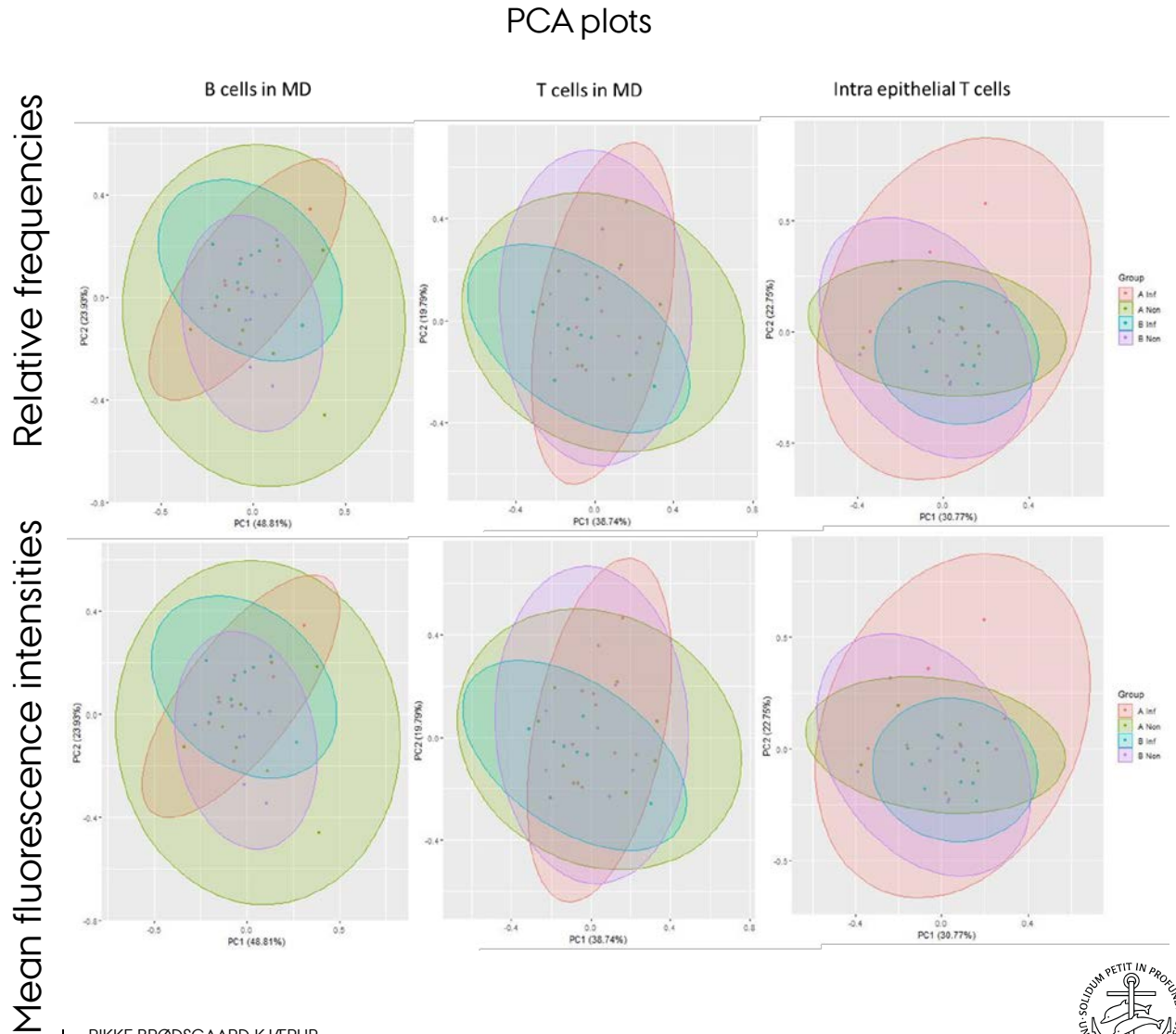
T cell examples:



PHENOTYPING OF INTRAEPITHELIAL AND MD LYMPHOCYTES

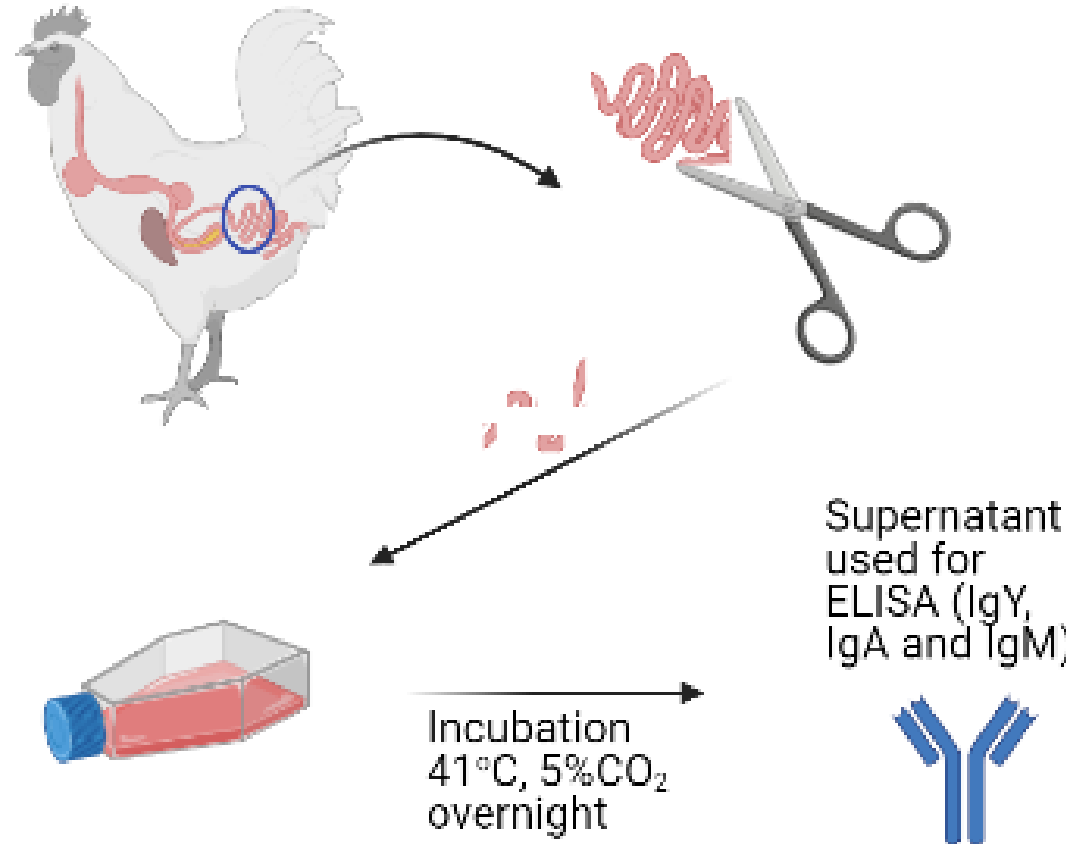
Isolating cells from Meckel's Diverticulum (MD) and ileum intraepithelial lymphocytes (IEL)

Immunophenotyping by flow cytometry:
-subset frequencies
-surface marker expression



IMMUNOCOMPETENCE: IGA PRODUCTION IN MUCOSA

Age of hens: 32 weeks (12 weeks p.i.)



Created in [BioRender.com](https://www.biorender.com) 

SUMMARY OF PRELIMINARY RESULTS

- Performance unaffected by feed B
- DM % week 7 p.i. and B cell counts week 4-12 p.i. affected by way of infection
- Feed B chickens higher worm burden irrespective of way of infection
- When naturally infected, feed B chickens had lower titers of *A. galli* specific IgY
- Feed B did not affect systemic immunocompetence or gut immune profiles
- In conclusion: Feed B had no adverse effects on general health parameters but did not seem to reduce *A. galli* burden when used in concentration of 6% during the 3 months experimental period

Treatment	Feed	Group name
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Challenge infected	Feed B 6%	B Inf
Naturally infected	Control (A)	A non
Naturally infected	Feed B 6%	B non

Thanks to



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Horizon 2020 project