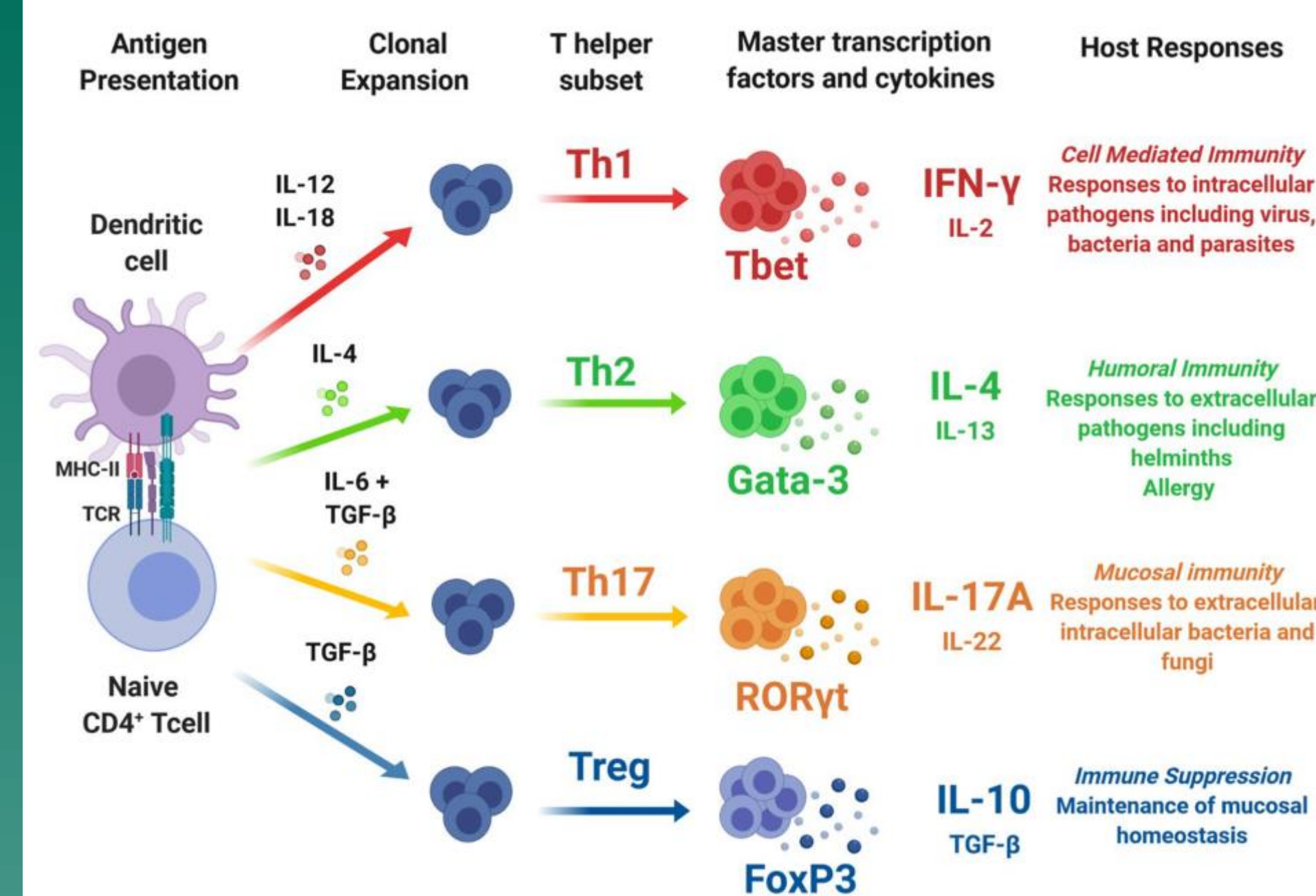
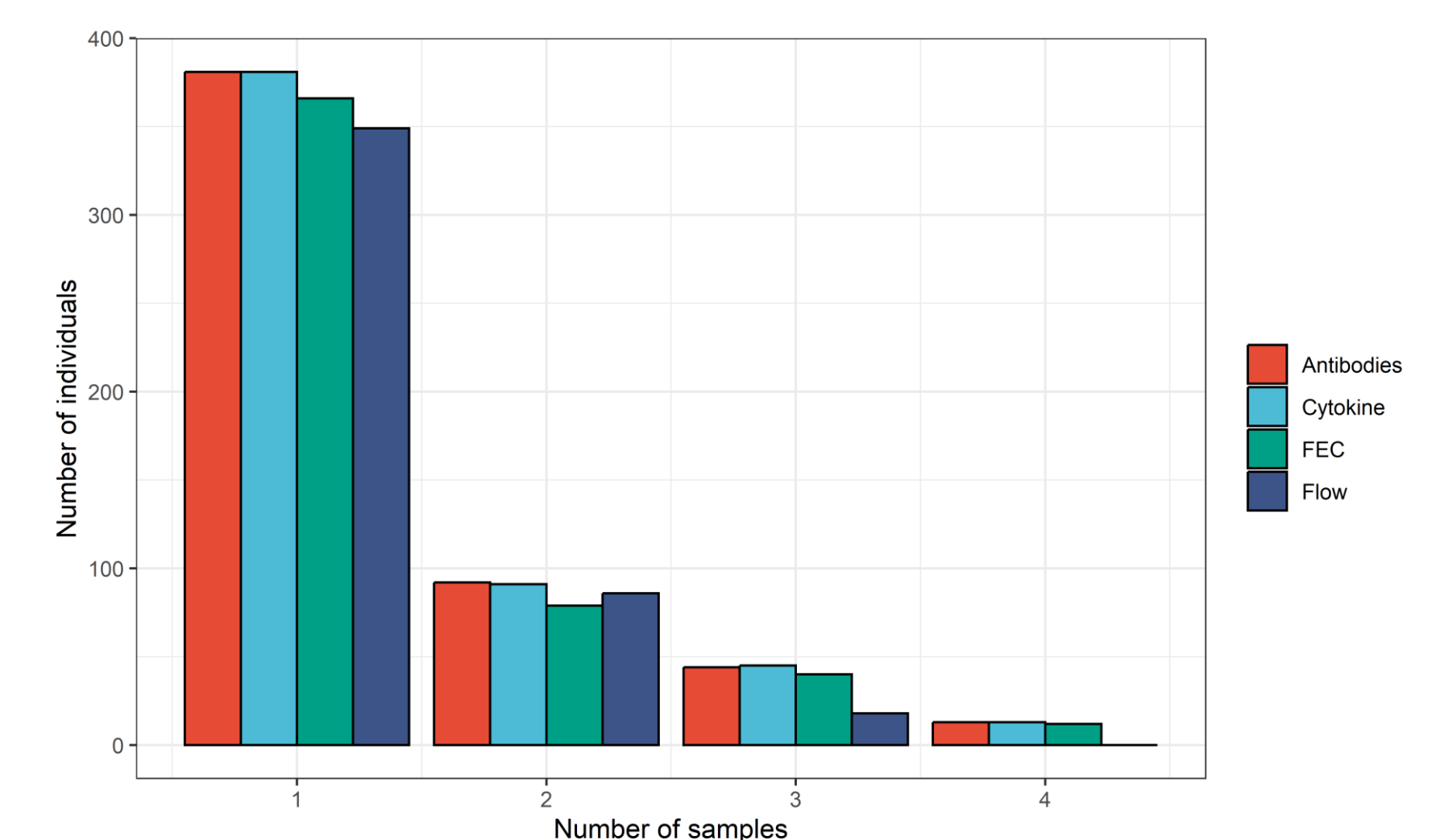


Individual variation in cytokine levels predicts parasite infection in wild Soay sheep

BONUS MATERIAL



The cell-mediated immune system drives different response types depending on the type of threat identified. Different Th cell subtypes, each expressing different transcription factors and cocktails of cytokines drive the downstream response.

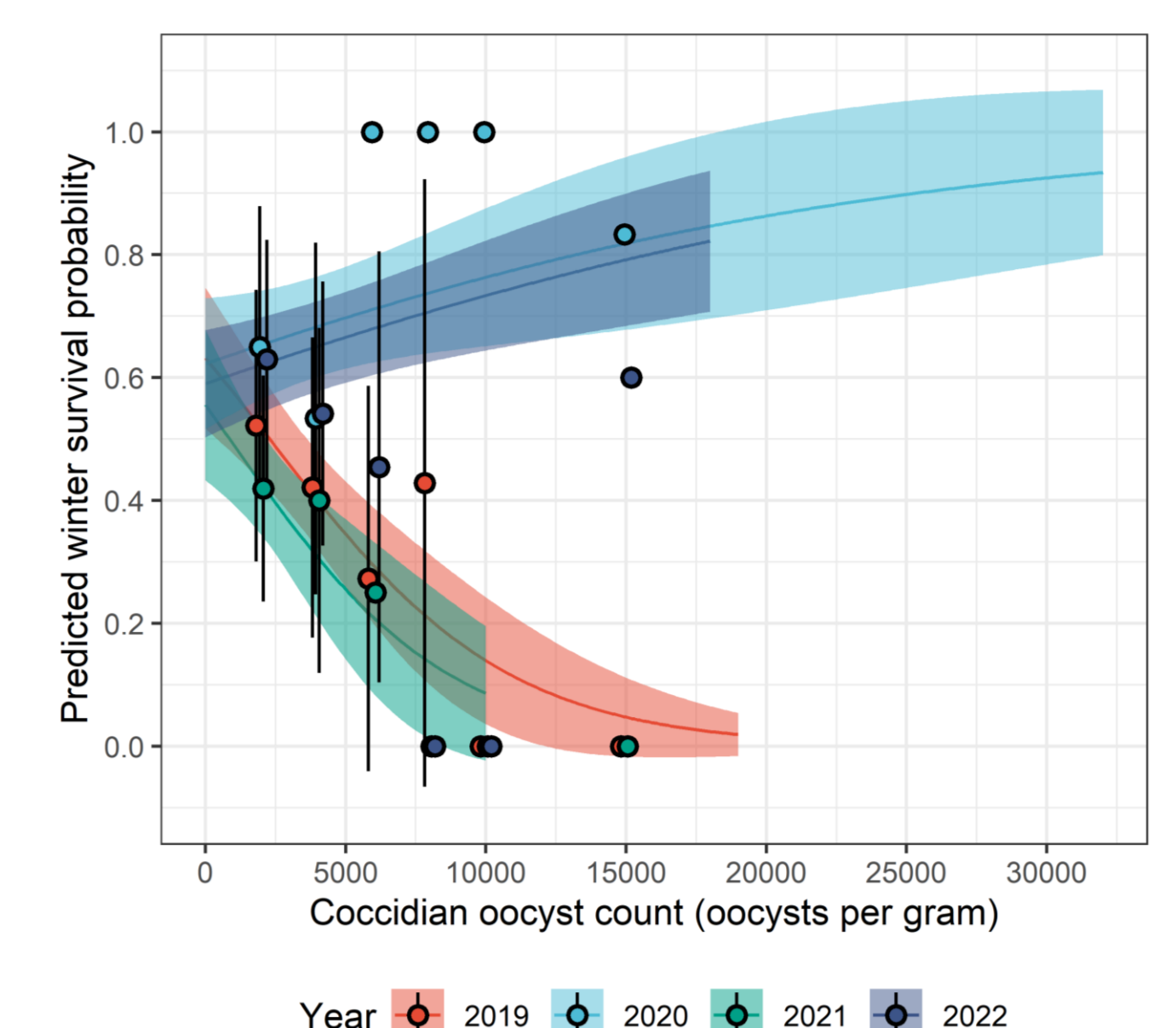


Sampling across years enabled us to recapture the same individuals more than once

Analysis of **age patterns** revealed that:

- CD4⁺ cell counts varied little with age or sex
- Cytokines increased with age
- Antibody levels were higher in adults than in lambs

Although we detected significant repeatability in some of our immune markers, we had insufficient data to estimate **heritability**



Our immune markers were not associated with **lamb survival**, but higher coccidian faecal oocyst count was linked to lower survival in 2/4 years

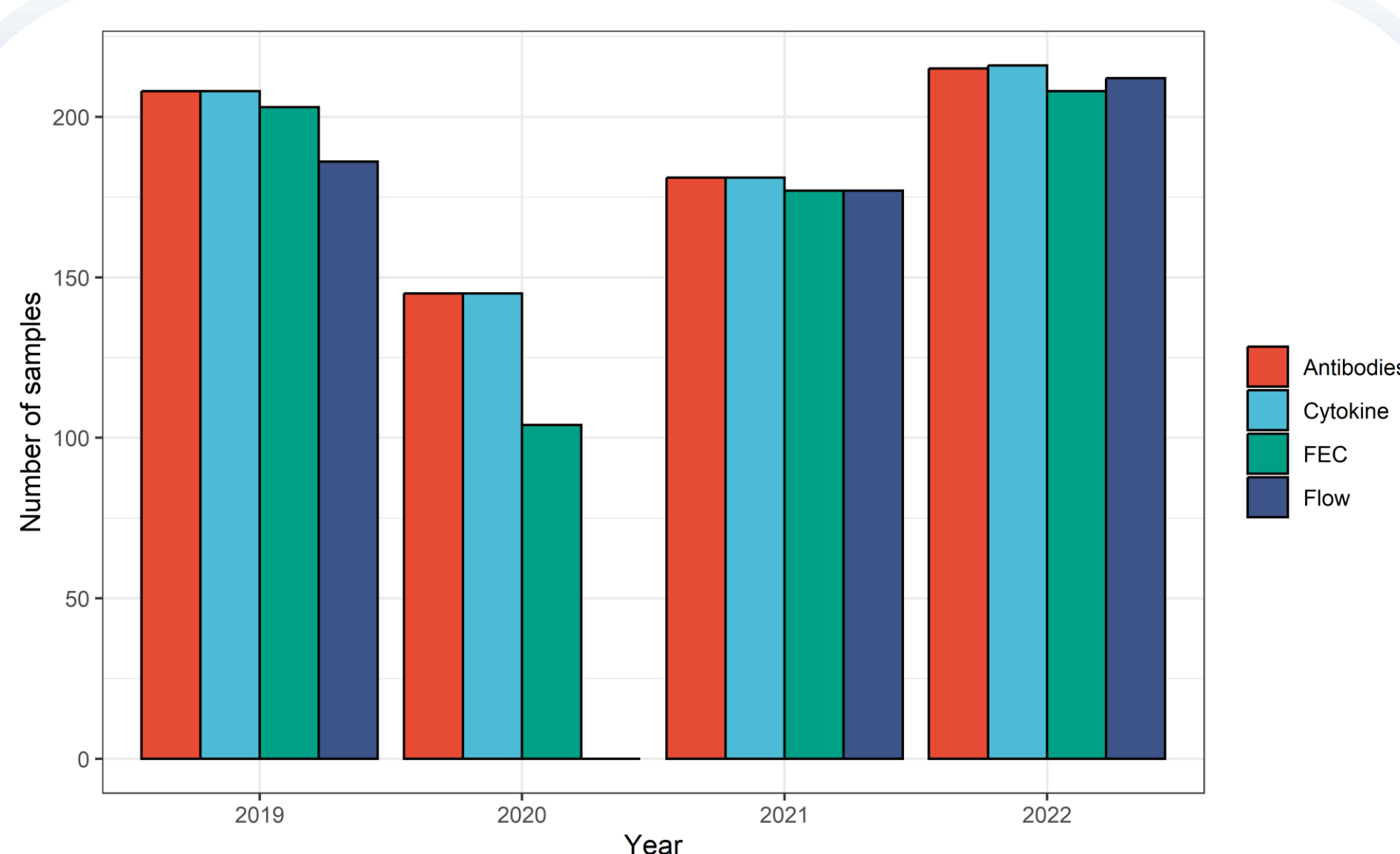
T-helper cell phenotypes are repeatable, positively correlated and associated with helminth infection in wild Soay sheep

Yolanda Corripio-Miyar, **Adam D. Hayward**, Hannah Lemon, Xavier Bal, Jill G. Pilkington, Josephine M. Pemberton, Daniel H. Nussey & Tom N. McNeilly

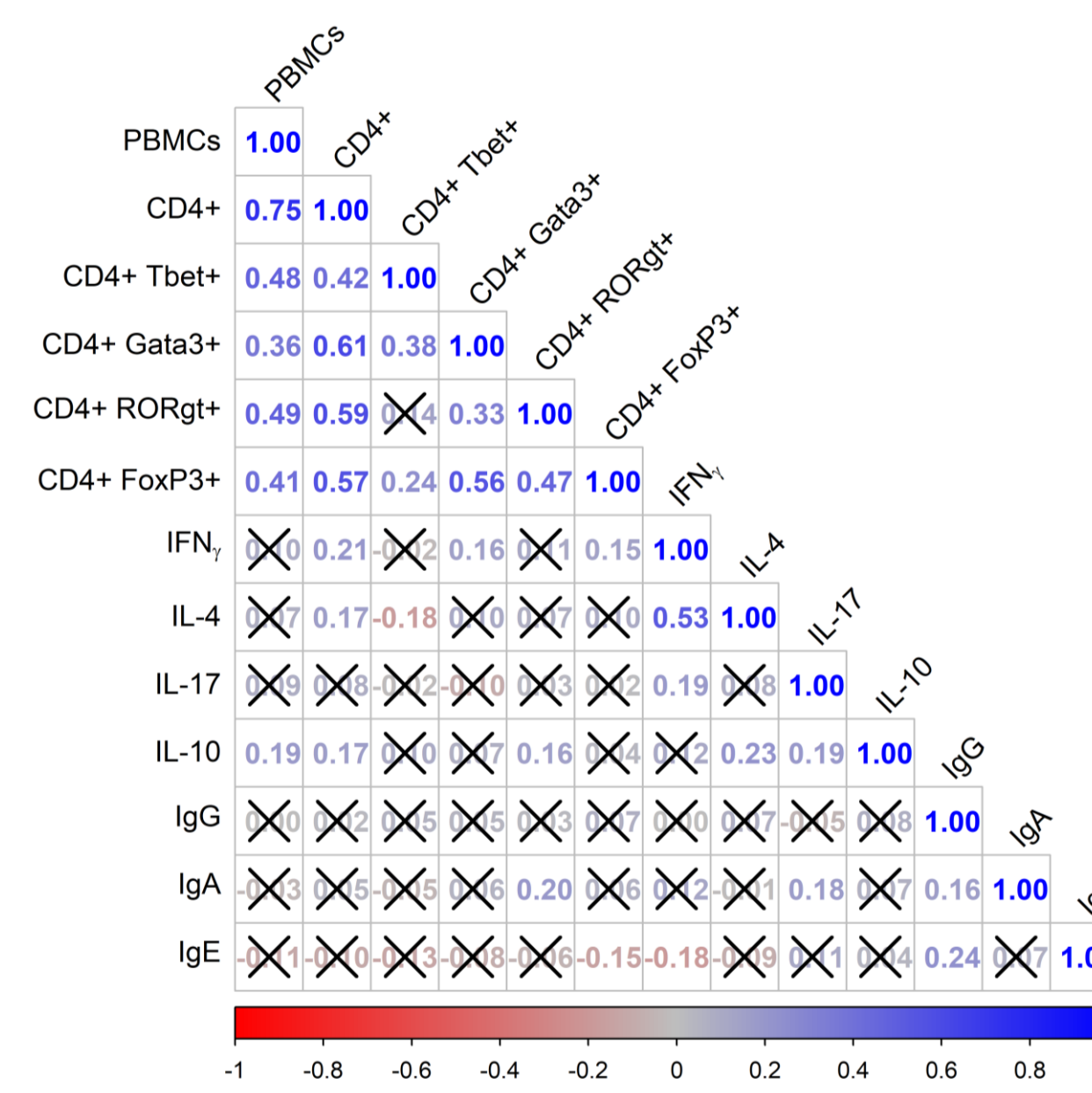
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Background: Understanding how and why the immune system varies amongst individuals in wild populations, and how different aspects of immunity are associated with parasite infection and fitness, could help us to determine how selection has shaped immune responses in natural populations.



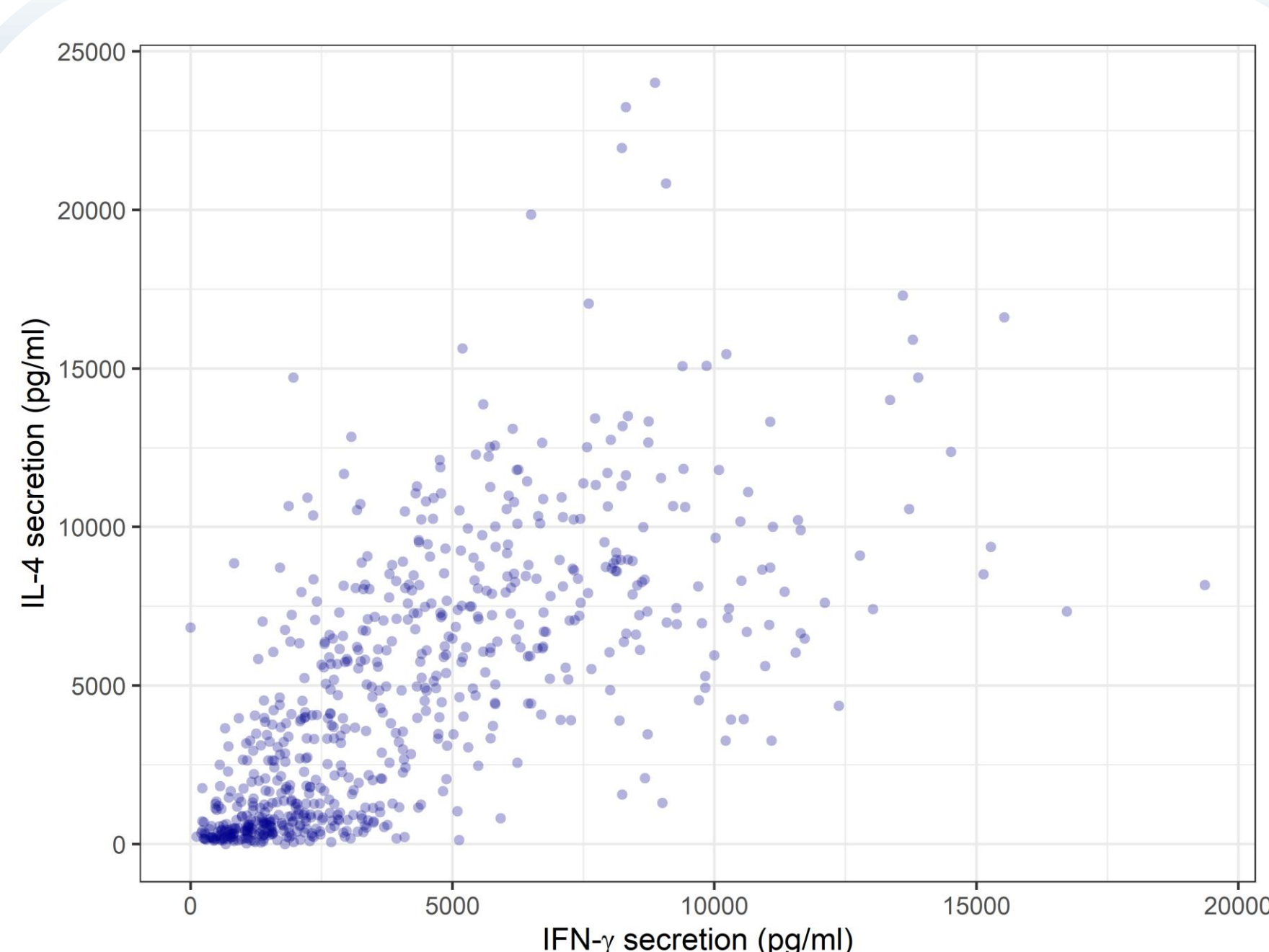
METHODS: We measured worm-specific antibody responses and cytokine levels by ELISA, CD4⁺ cell counts with flow cytometry and worm faecal egg counts in **750 samples** collected from **538 sheep**



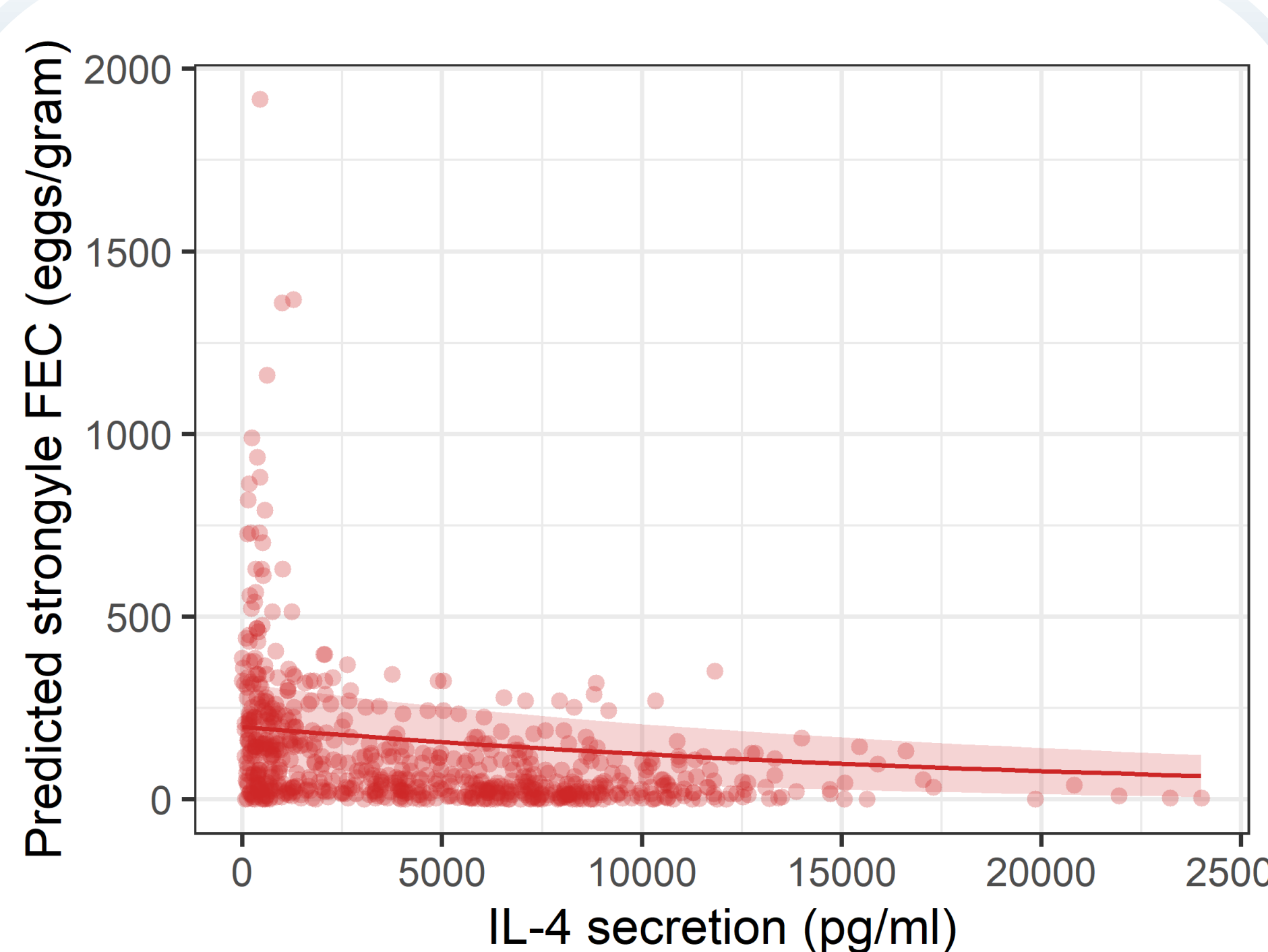
RESULT 1: CD4⁺ cells, cytokines and antibodies were positively correlated **with each other**, but different types of immune measures were not correlated

RESULT 2: Analysis of **repeatability** suggests that CD4⁺ cell counts, IFN-γ, IL-4 and worm-specific antibodies vary significantly among individuals. Estimates show proportion of variation explained by individual ID.

CD4 ⁺	IFN-γ	IL-4	IgG	IgA	IgE
0.23 (0.07-0.38)	0.28 (0.17-0.34)	0.29 (0.17-0.37)	0.61 (0.52-0.68)	0.53 (0.39-0.62)	0.58 (0.50-0.64)



RESULT 3: Bivariate mixed-effects models suggest that the Th1- associated cytokine **IFN-γ** and the Th2-associated **IL-4** are positively correlated at the **among-individual level** (+0.34, HPDI=0.04-0.64)



RESULT 4: **IL-4** was negatively associated with nematode **faecal egg count**, suggesting a **Th2 response** is associated with **resistance** to worms.

