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► **To cite this version:**

Marie-Hélène Pinard-van Der Laan, Edin Hamzic, Kay Boulton, Androniki Psifidi, Pete Kaiser, et al.. Serum IL-10, a novel diagnostic biomarker of resistance in the domestic chicken to coccidiosis. 14. Avian Immunology Research Group (AIRG) Meeting 2016, Sep 2016, Herrsching, Germany. , 2016. hal-01585738

HAL Id: hal-01585738

<https://hal.science/hal-01585738>

Submitted on 11 Sep 2017

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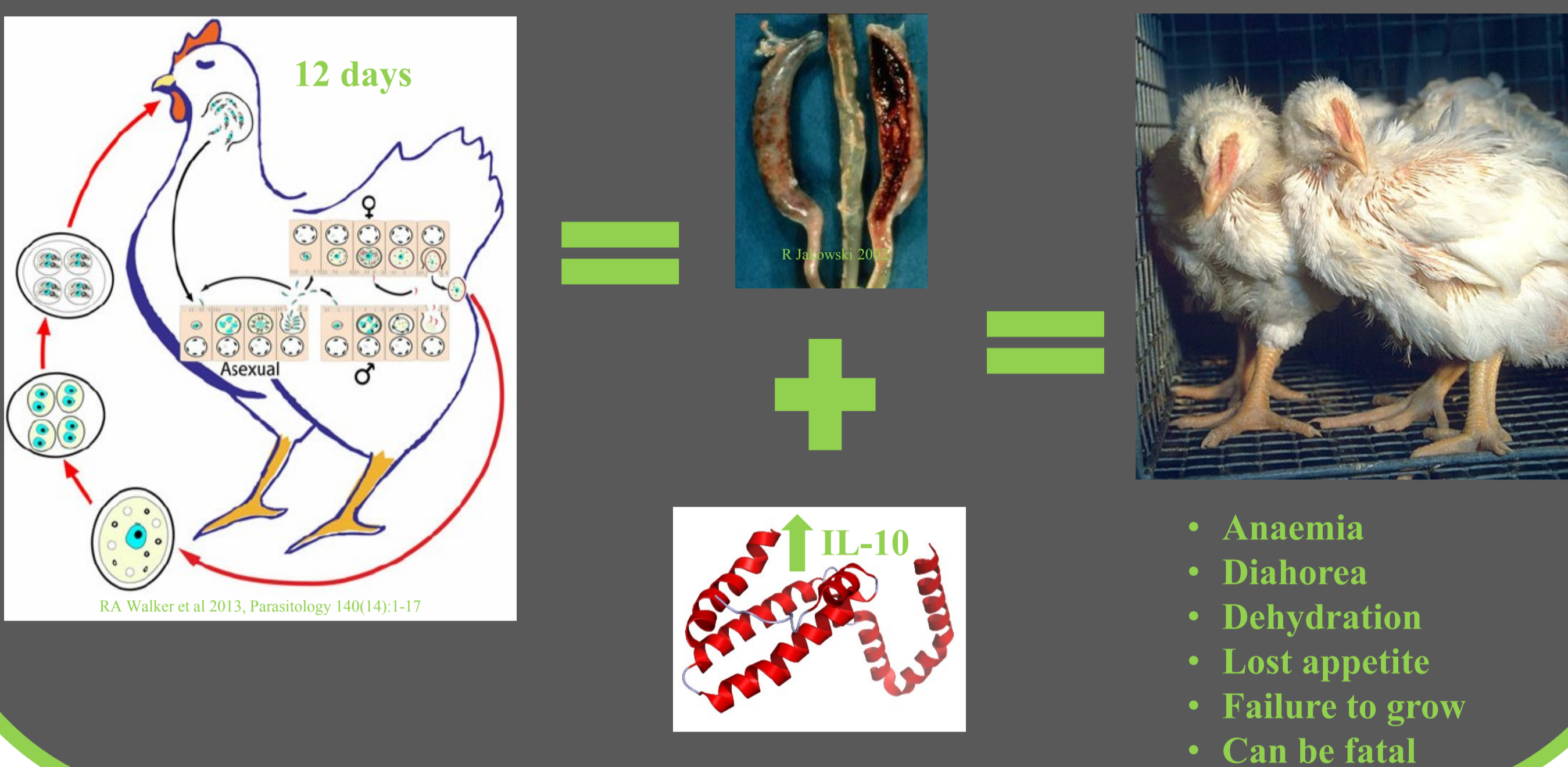
PROSLIN

Serum IL-10, a novel diagnostic biomarker of resistance in the domestic chicken to coccidiosis

Kay Boulton¹, Matthew J. Nolan², Zhiguang Wu¹, Kimberly Harman³, Androniki Psifidi¹, Edin Hamzic⁴, Marie-Helene Pinard-van der Laan⁴, Pete Kaiser¹, Fiona M. Tomley², Mitchell Abrahamsen³, Rachel Hawken³, Damer P. Blake², David A. Hume¹

BACKGROUND

- ***Eimeria* spp = Coccidiosis**
 - Costs international poultry industry ≈ \$3.5 bn/year in loss of production and disease control
 - Legislation exists in many countries to reduce the extent of prophylactic antibiotics administered to animals bred for human consumption
- **Selective breeding for natural resistance**
 - Depends on identification of suitable diagnostic biomarkers
- **Hypothesis**
 - Level of circulating IL-10 affects level of resistance



MATERIALS & METHODS

- **Experimental procedure**
 - Day-old Cobb500 birds reared under usual commercial conditions
 - ❖ ***Eimeria tenella*:**
 - Large-scale trials (N = 1000 + 200 control) at RVC
 - ❖ ***Eimeria maxima*:**
 - Subset of 76 birds at INRA [Hamzic et al, 2016]
- **Trial protocol:**

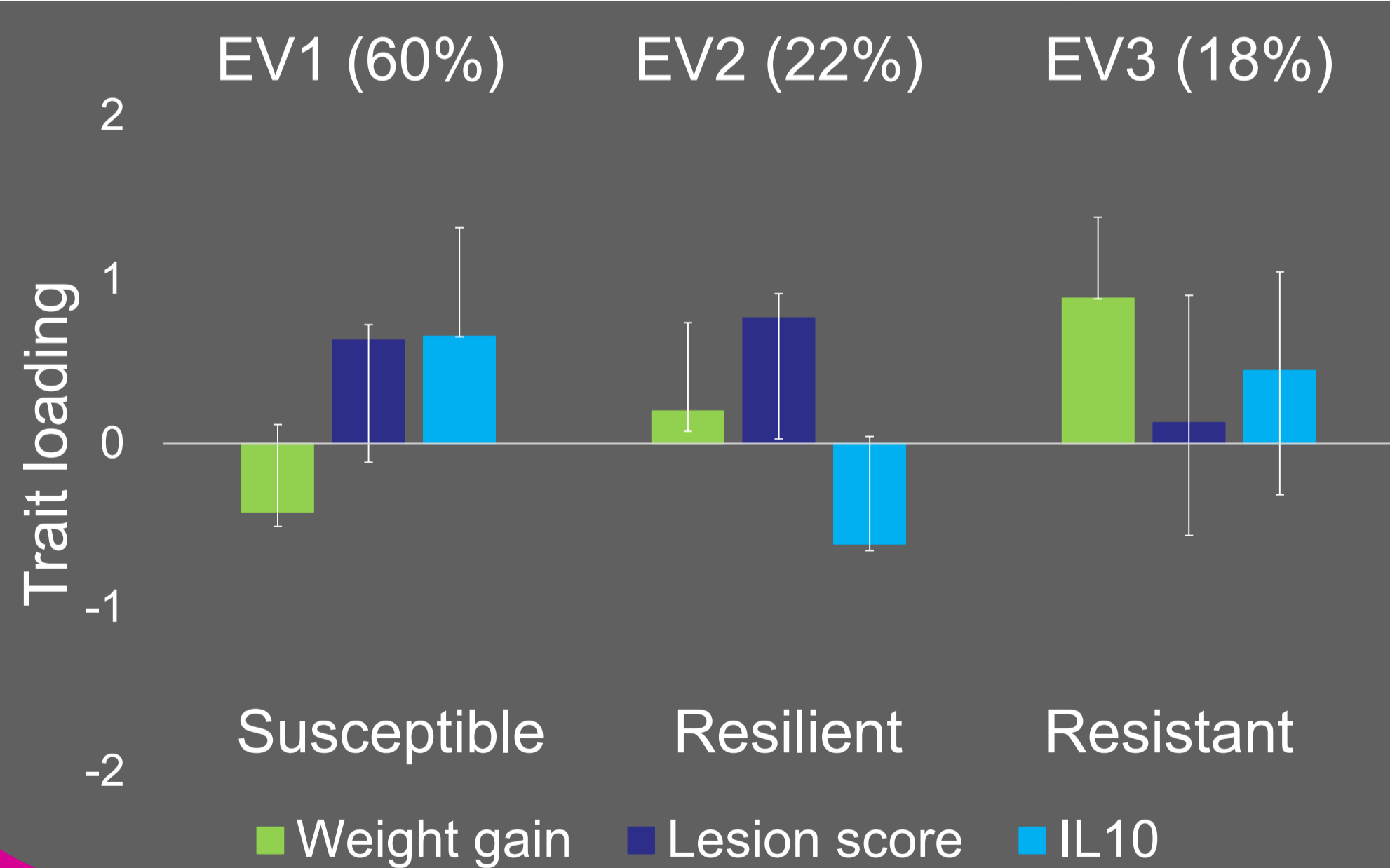
Days post infection (dpi)	Challenge (sporulated oocysts)		Weight (g)	Blood sample (1.5 ml)		Lesion score (0-4)
	<i>E. tenella</i> 42,500	<i>E. maxima</i> 50,000		<i>E. tenella</i>	<i>E. maxima</i>	
-2			X			
0	X	X				
4.5			X	X		
6.5 (PM)			X		X	X

- **Serum IL-10**
 - Concentration measured using capture ELISA [Wu et al, 2016]
- **Statistical analyses**
 - Multivariate mixed model using ASReml

RESULTS

❖ *Eimeria tenella*

V _P	Weight Gain	Lesion Score	Serum IL-10
Weight Gain	0.65 (0.03)	-0.34 (0.03)	-0.38 (0.03)
Lesion Score	-0.27 (-9.8)	0.93 (0.04)	0.43 (0.03)
Serum IL-10	-0.30 (-9.8)	0.40 (0.04)	0.94 (0.05)



Between-trait correlations

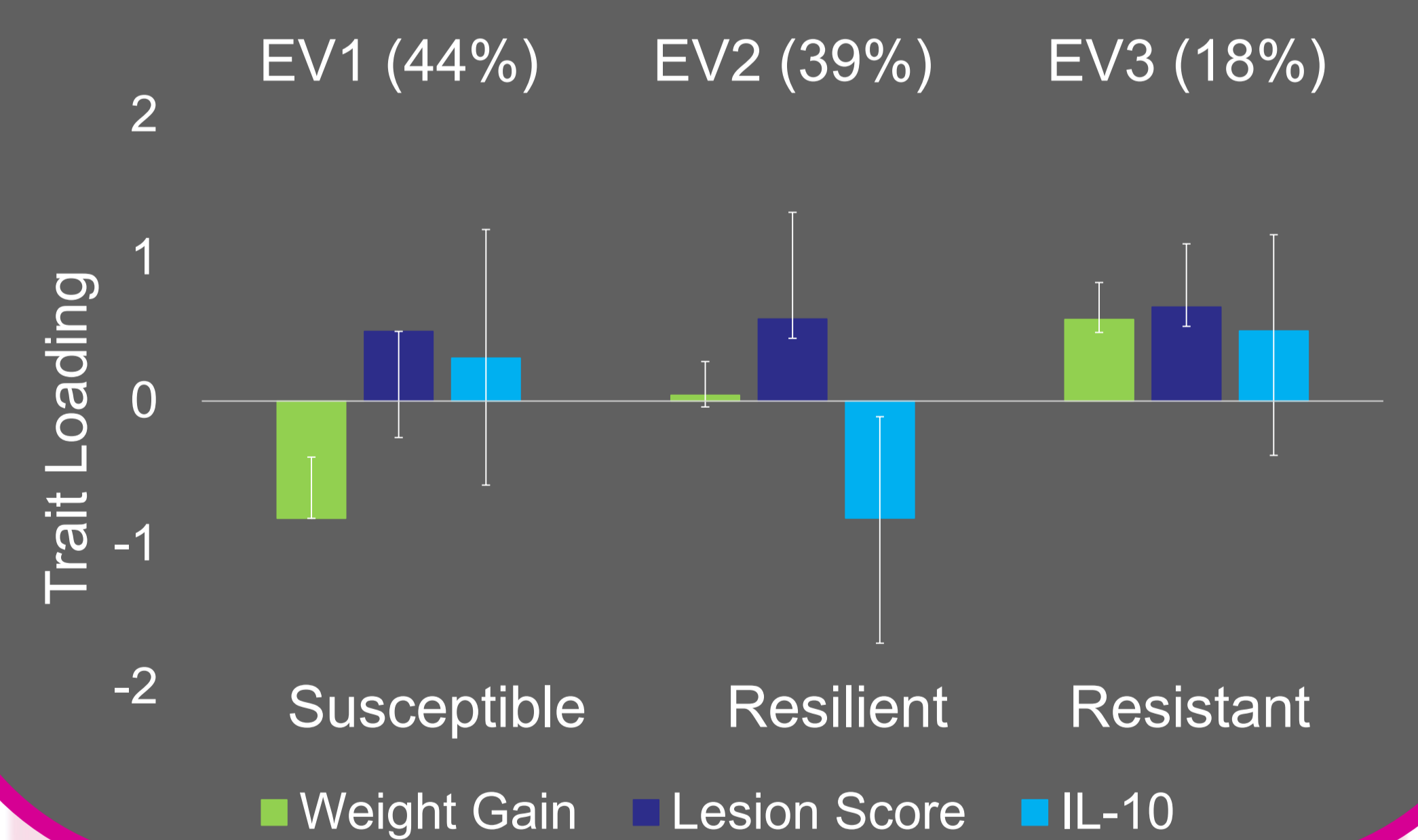
Phenotypic variance on diagonal
 ← co-variance below correlations above →

Eigen analysis of co-variance
 (error bars represent 95% Highest Probability Density)



❖ *Eimeria maxima*

V _P	Weight Gain	Lesion Score	Serum IL-10
Weight Gain	1.01 (0.17)	-0.30 (0.11)	-0.21 (0.11)
Lesion Score	-0.28 (-2.5)	0.89 (0.15)	-0.20 (0.12)
Serum IL-10	-0.21 (-1.7)	-0.18 (-1.6)	0.99 (0.17)



DISCUSSION

- ❖ ***E. tenella*:** Visualisation of Eigen analysis explains the imperfect between-trait correlations. Phenotypic “immunity” to coccidiosis comprises both resistance and resilience, and is not simply the inverse of susceptibility.
- Natural resistance to coccidiosis is clearly a continuous axis (as opposed to resistant/susceptible) with level of serum IL-10 at the peak of infection playing an important role in this differentiation.
- Genetic analysis is now required to explore significant SNPs for the three traits and suggest candidate genes. Calculation of heritability and GEBVs will determine the likelihood of breeding for optimum level of serum IL-10.
- Further studies could enlighten the exact role of IL-10 during coccidiosis. For example, is serum IL-10 produced in response to the protozoan invasion or secondary bacterial infections?
- ❖ ***E. maxima*:** The difference between resistance and resilience is not as clear cut; however, this could be due to lack of power from smaller data sample.

REFERENCES

Hamzic et al 2015, Large-scale investigation of the parameters in response to *Eimeria maxima* challenge in broilers, Journal of Animal. Science 2015.93:1830–1840

Wu et al, 2016, Analysis of the function of IL-10 in chickens using specific neutralising antibodies and a sensitive capture ELISA. Developmental and Comparative Immunology 63 (2016)

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