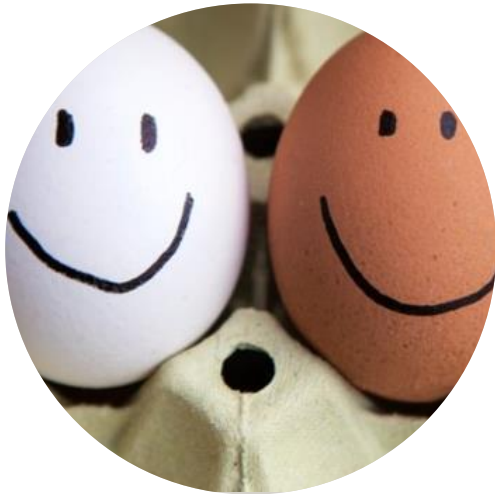


Genetic parameters of resilience, production, and immunocompetence in chickens

Tom Berghof



Co-authors & Acknowledgement

Wageningen University & Research

- Han Mulder

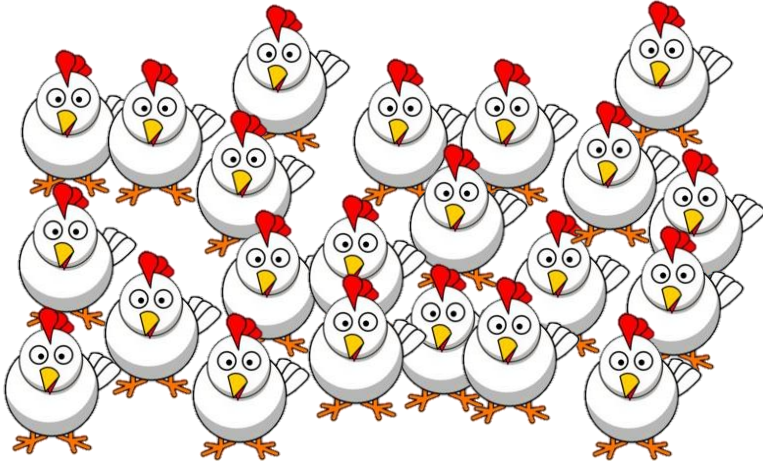
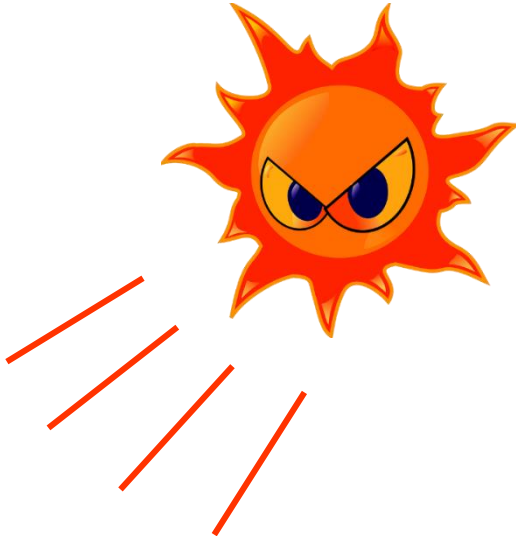
Hendrix Genetics

- Katrijn Peeters
- Jeroen Visscher

ERA-NET SusAn/NWO-ALW
Hendrix Genetics



Resilience

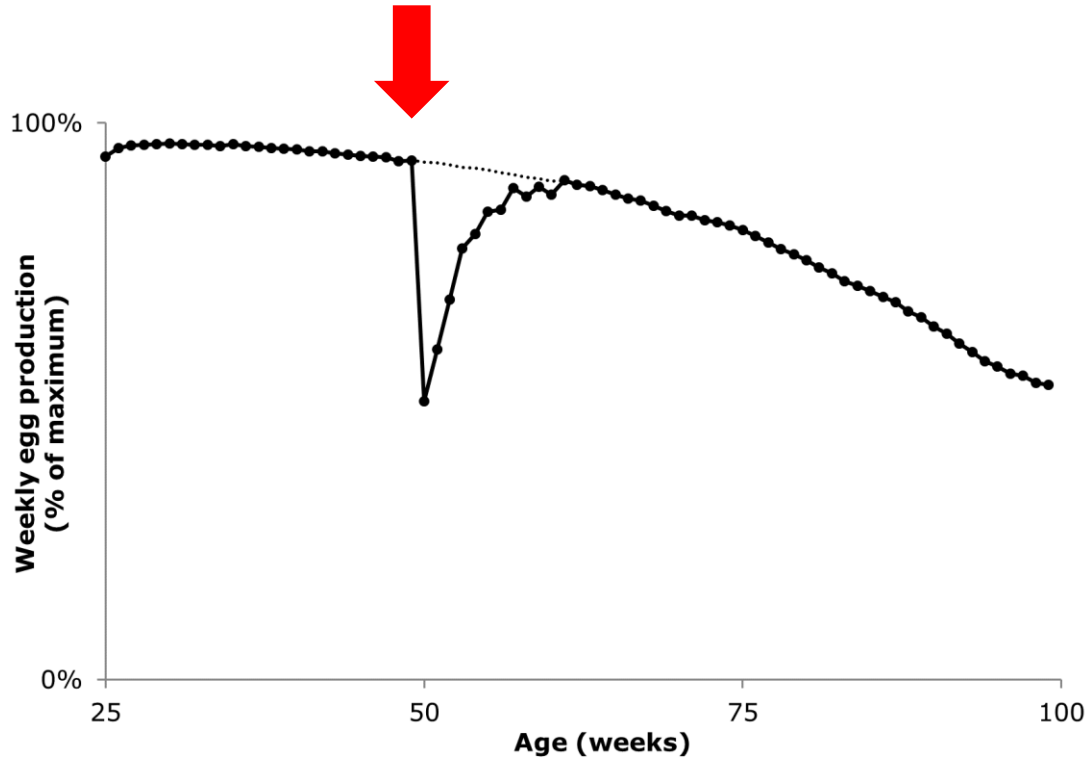


Resilience

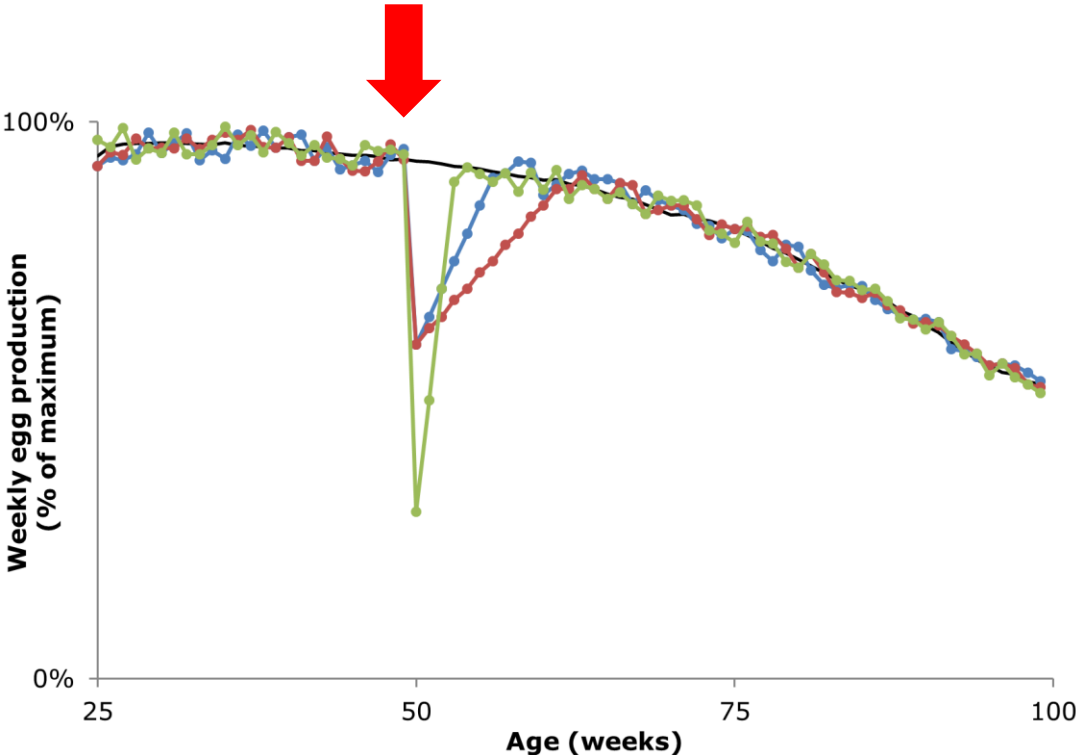
the capacity of an animal
to be minimally affected by disturbances,
or
to rapidly return to the state pertained
before exposure to a disturbance”

(Berghof et al. 2019, Front Genet)

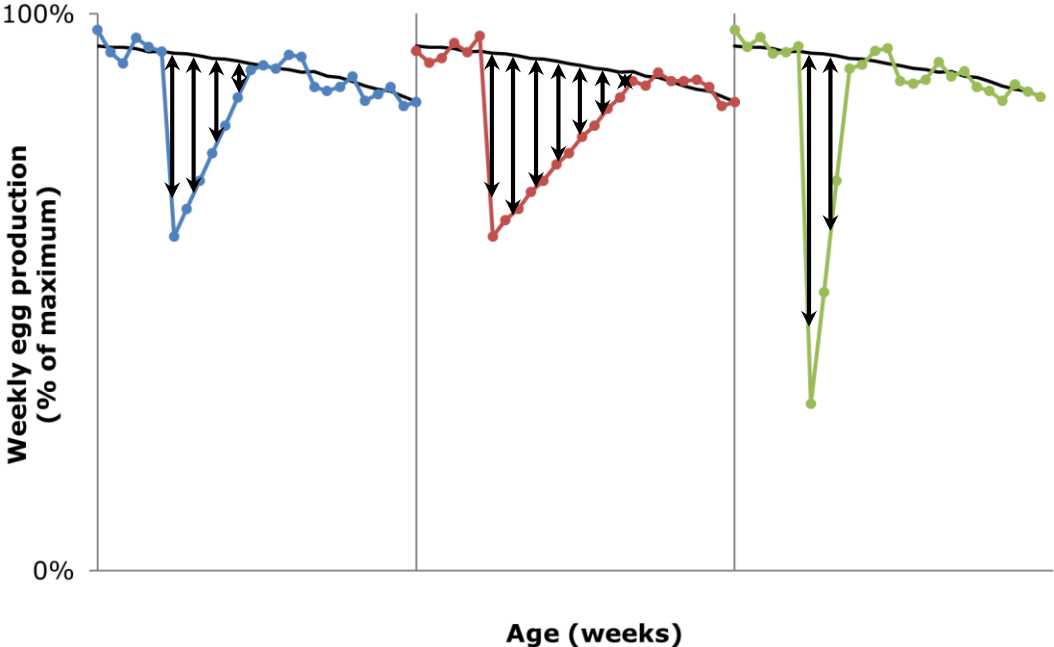
Disturbance



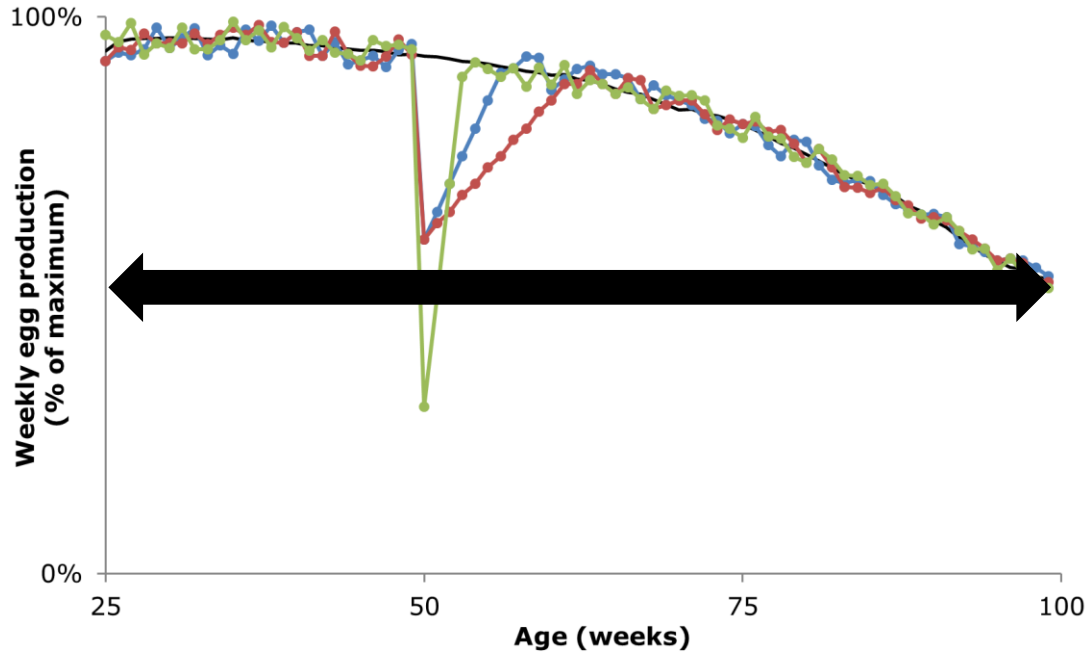
Disturbance



Disturbance causes deviations



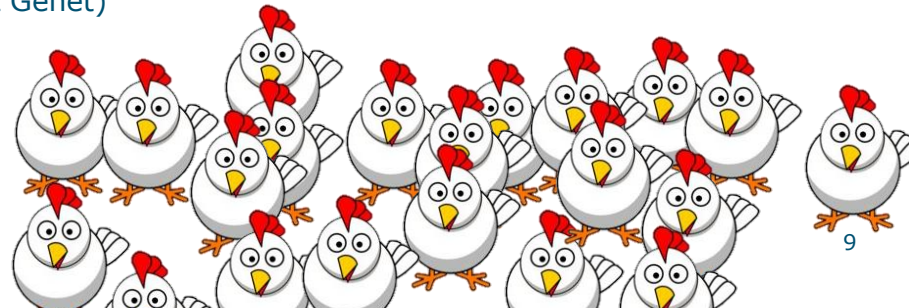
Disturbances cause deviations during production



Resilience based on deviations

- Resilient animals have fewer or smaller deviations
- Proposed resilience indicator $\rightarrow \ln(\text{variance of deviations})$
- $\ln(\text{variance})$ associated to disease occurrence and longevity/survival

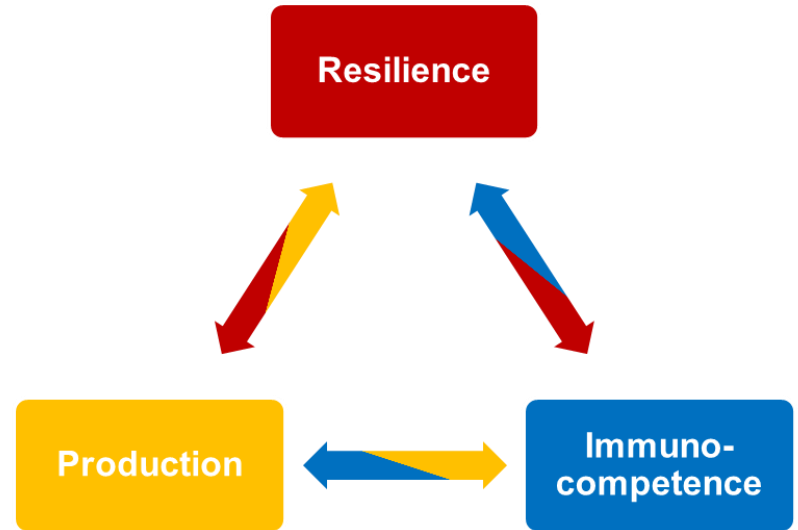
(Elgersma et al., 2018, J Dairy Sci; Putz et al., 2019, Front Genet)



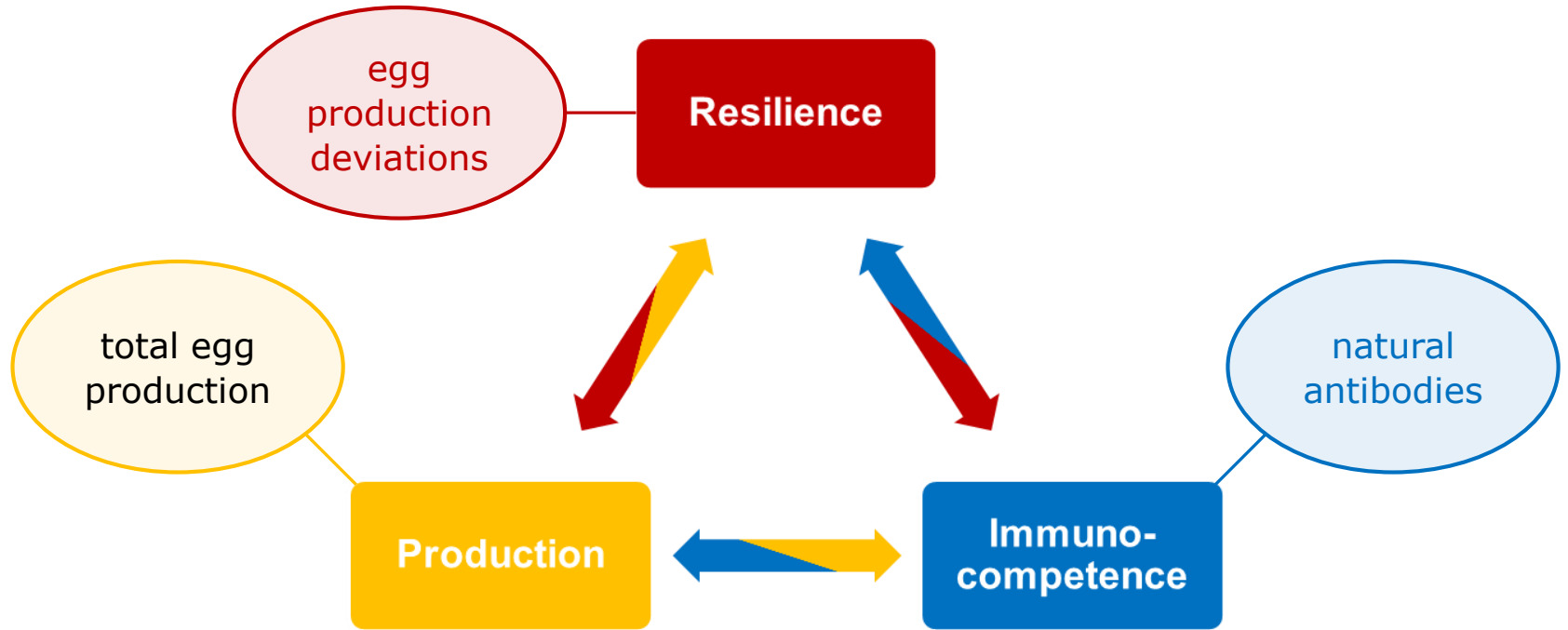
Aim

To investigate genetic parameters of **resilience**, **production**,
immunocompetence

1. estimate heritabilities
2. estimate genetic correlations



Phenotypes



Natural antibodies



Antigen binding antibodies present in individuals without exposure to this antigen

→ total keyhole limpet hemocyanin-binding natural antibodies at 16 weeks of age

- heritable (e.g. Berghof et al., 2015, PLoS ONE)
- associated to survival (e.g. Star et al., 2007, Poult Sci)

selection experiment: S49_p23 (Berghof, 2018, PhD dissertation)



Objectives

- Divergently select layer chickens for total KLH-binding natural antibody titer
- Investigate correlated selection responses
- Investigate differences in *E. coli* disease resistance (proof-of-principle)

Conclusions

- Selective breeding on KLH-binding natural antibodies is possible
- No (observed) negative correlated responses
- High line has increased *E. coli* disease resistance compared to Low line

Background

Natural antibodies (NAbs) are antibodies present in individuals without previous exposure to the recognized antigen. NAbs binding Mytilus limpet haemocyanin (KLH) are:

- abundant (0.1 - 0.25 g/L serum)
- associated with increased survival in turkeys (e.g. Star et al., 2007)

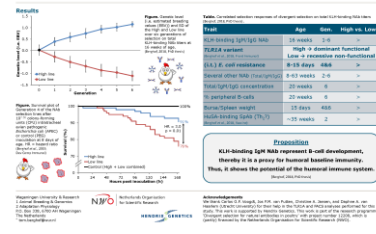
Materials & Methods

Layer chickens
~1,700 individuals

Challenge experiment
~500 individuals / first generation

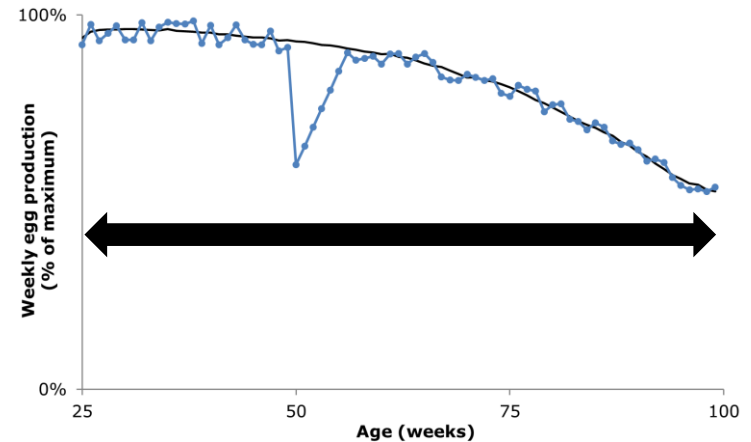
Selection criterion
Total KLH-binding NAbs
at 16 weeks of age

High line
Low line

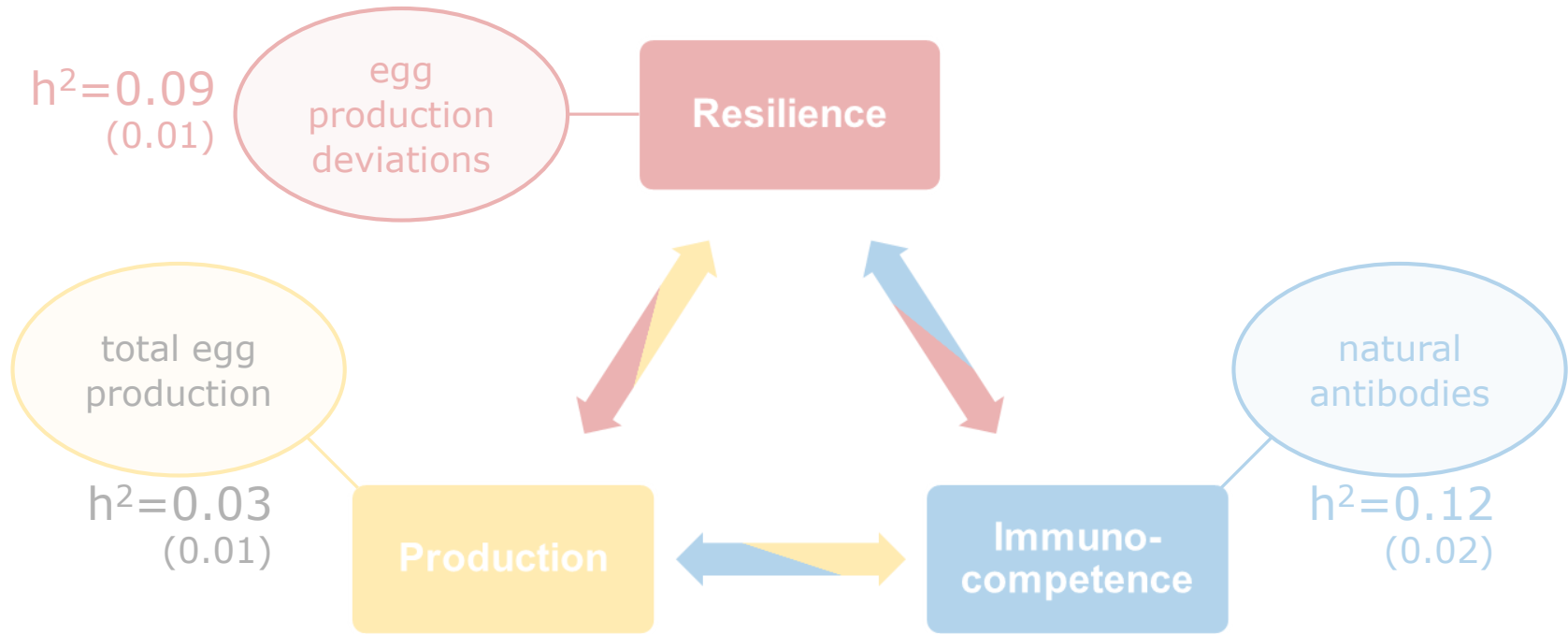


Study population

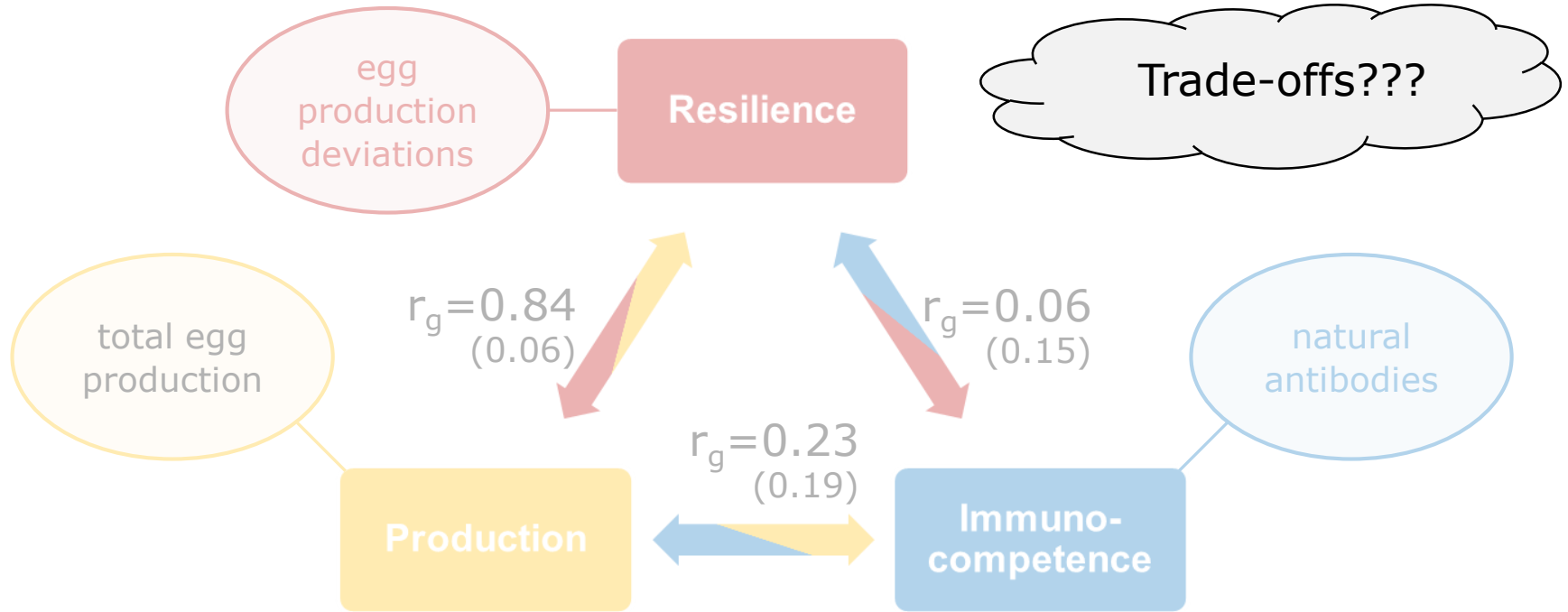
- 25,819 purebred WA chickens (♀: 24,063)
 - total egg production
 - egg production deviations
 - deviation: expected – observed
 - expected: average of cohort*
 - $\ln(\text{variance of deviations})$
 - natural antibodies (4,855)



1. estimate heritabilities



2. estimate genetic correlations



Take-home messages

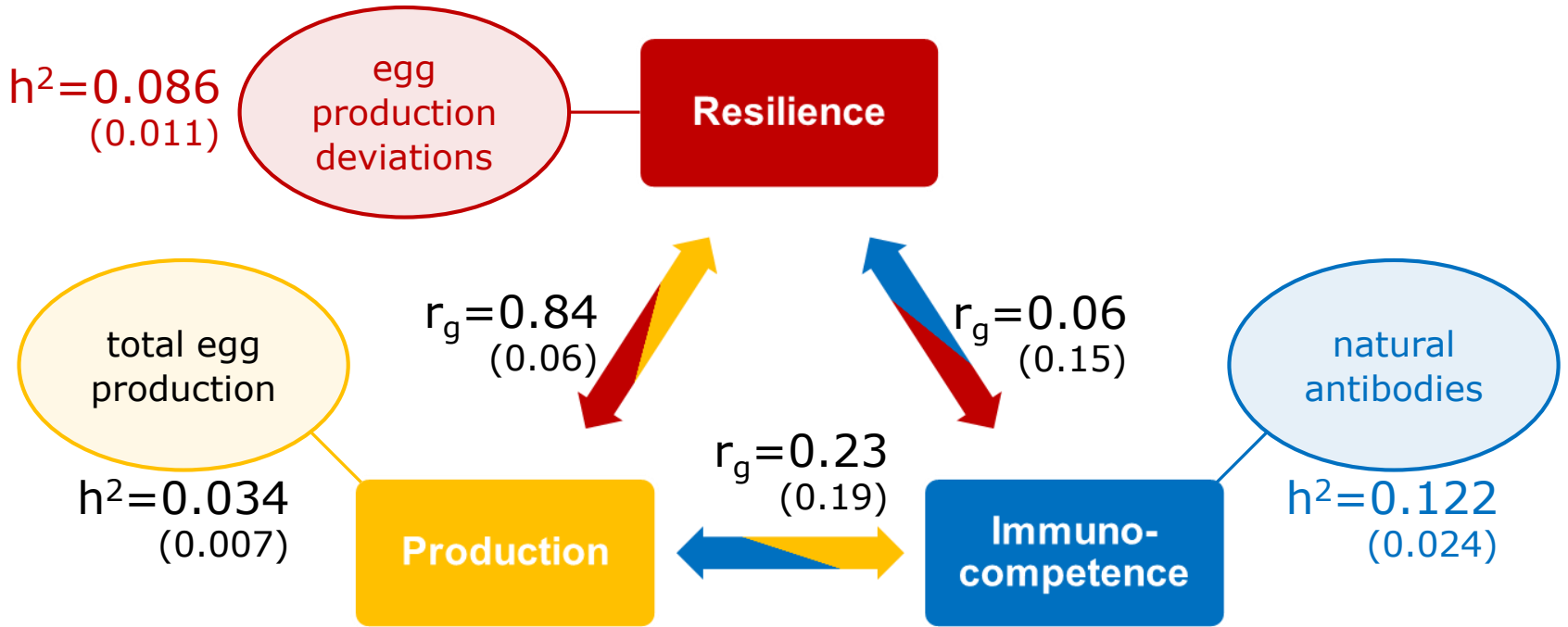
Resilience is heritable.

Especially resilience, and also immunocompetence have a favorable genetic correlation with production,
but no genetic correlation with each other.



tom.berghof@wur.nl

Overview of results



Overview of survival results

