

Selective breeding on natural antibodies in chickens: selection response, and correlated responses

Tom V.L. Berghof^{1,2}, Jan J. van der Poel², Joop A.J. Arts¹, Henk Bovenhuis², Marleen H.P.W. Visker², Henk K. Parmentier¹



Objectives

- Investigate possibility of divergent selection on total KLH-binding natural antibody titers in layer chickens.
- Investigate possible correlated selection responses.

Background

- Natural antibodies (NAb) are antibodies present in individuals without previous exposure to the recognized antigen.
- NAb binding Keyhole Limpet Hemocyanin (KLH) are:
 - heritable ($h^2 = 0.07-0.14$)¹.
 - associated with increased survival in layers.

Materials & Methods²

Base population

- Layer chickens
- ~3,700 individuals



Results

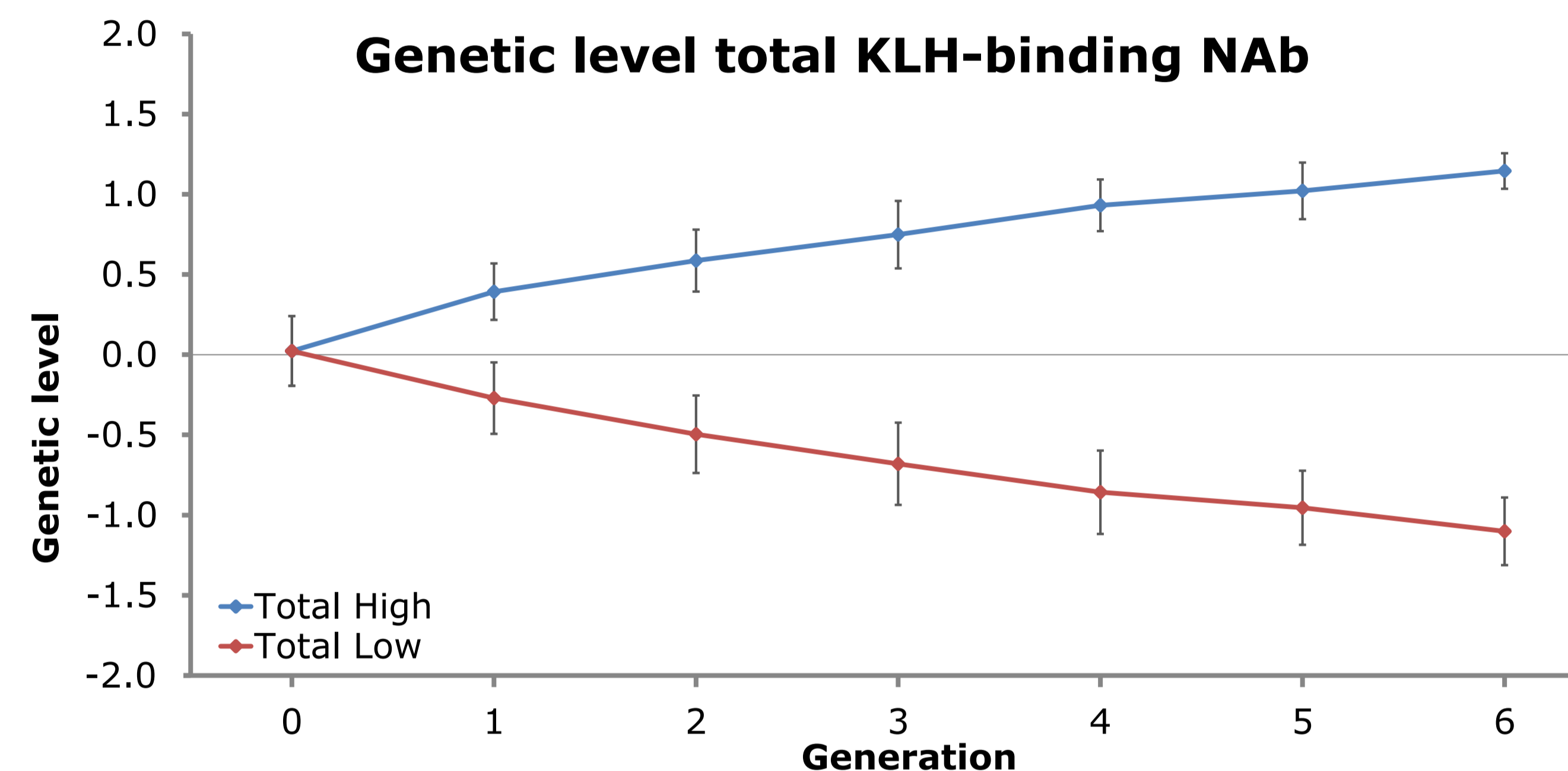


Figure. Average genetic level (i.e. estimated breeding values (EBV)) and SD of total KLH-binding NAb titers (Total) over six generations of divergent selection on total KLH-binding NAb titers.

Table. Correlated selection responses as a result of divergent selection on total KLH-binding NAb titers.

Trait	Age	Gen.	High vs. Low
KLH-binding IgM/IgG NAb	16 weeks	1-6	>
Several NAb (Total/IgM/IgG)	8-63 weeks	2-6	>
(presumed) <i>TLR1A</i> variant ³	-	6	High: C-variant Low: G-variant
Total/IgM/IgG concentration	20 weeks	6	>
% peripheral B cells	20 weeks	6	>
Bursa/Spleen weight	15 days	4&6	>
(i.t.) <i>E. coli</i> resistance	8-15 days	4&6	>
KLH/PPD-binding SpAb ($Th_1?$)	~35 weeks	2	=
HuSA-binding SpAb ($Th_2?$)			>

Conclusions

- Selective breeding on KLH-binding natural antibodies is possible.
- Selective breeding has no (observed) negative correlated selection responses.

Speculation

KLH-binding (IgM) NAb represents the ontogeny of B cells in chickens. Thereby being a proxy for the humoral baseline immunity of an individual, i.e. showing the potential of the humoral immune system.

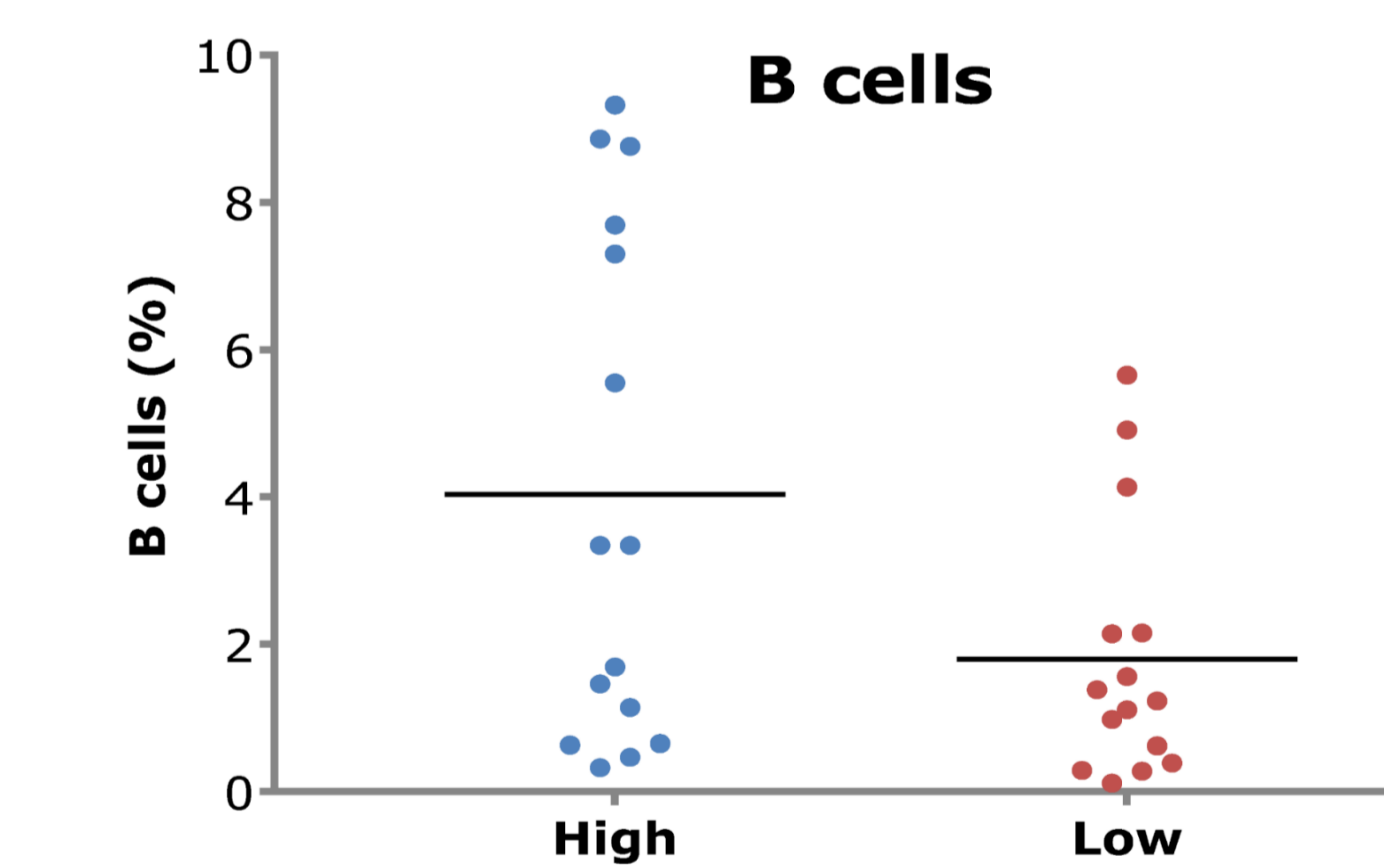


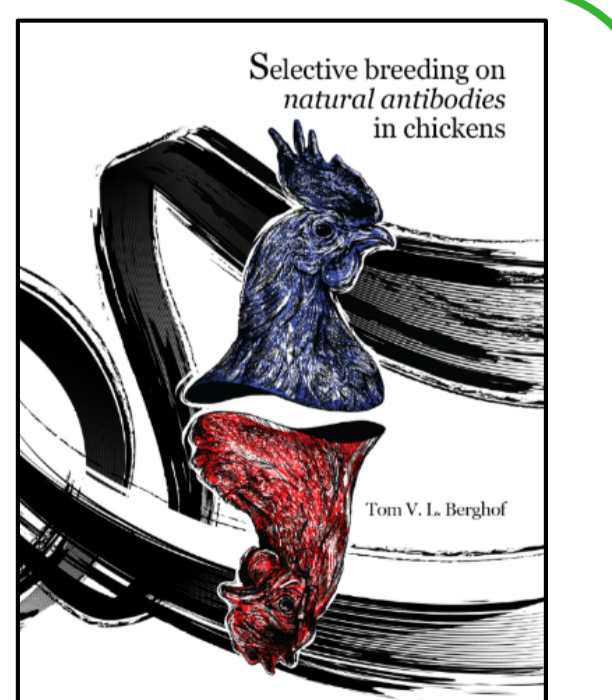
Figure. Percentage of peripheral B cells at 20 weeks of age of 15 selected females per line of generation 6, and mean percentage. ($p=0.07$; KW test)

A PhD thesis on a poster? Impossible!

Interested in a hard or soft copy?
Ask me or send me an e-mail:
tom.berghof@wur.nl

References (and part of PhD thesis): Berghof *et al.*,

¹ 2015, PLoS ONE; ² 2018, Vaccine, ³ 2018, Front Immunol



Acknowledgements

We thank Christine A. Jansen and Daphne A. van Haarlem (Utrecht University) for their help in FACS analyses performed for this work. This work is supported by Hendrix Genetics. This work is part of the research programme 'Divergent selection for natural antibodies in poultry' with project number 12208, which is (partly) financed by the Netherlands Organisation for Scientific Research (NWO). We thank the British Poultry Science and the Houghton Trust for providing a travel grant to present this poster at the Avian Immunology Research Group meeting 2018.