

White Hens Are from Venus, Brown Hens Are from Mars

Strain differences in behavioural biology and implications for cage free housing

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What colour eggs do you like?



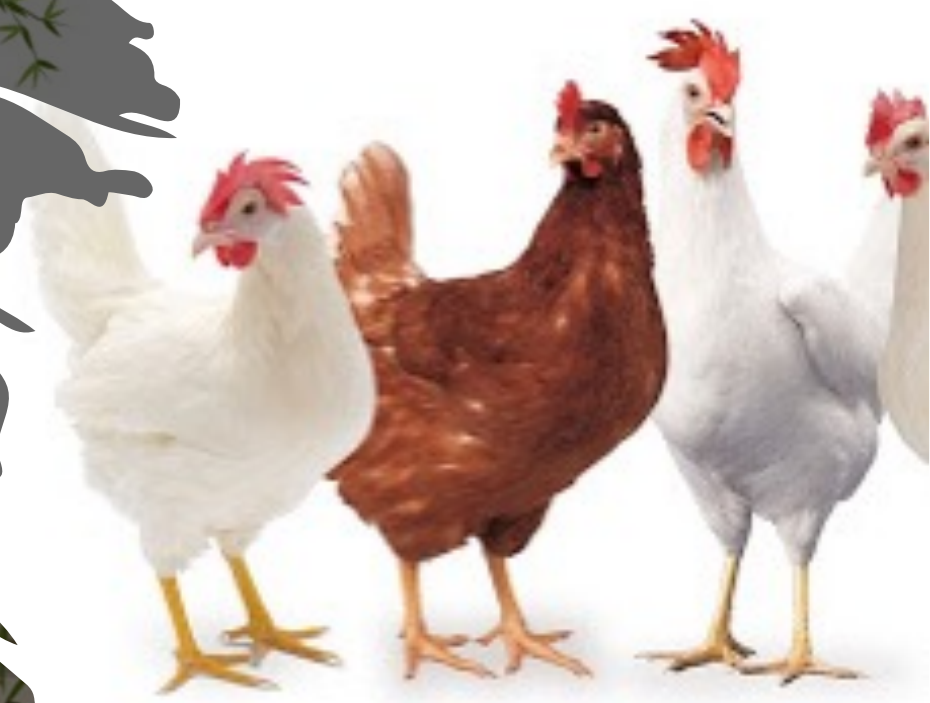
- Consumer preferences
- Strain differences in production traits
 - Body size, egg size, feed efficiency
- Strain differences in behaviour
 - Matching strain to system
- Locomotion
- Use of space and resources
- Response to fear

- Evolution
 - Jungle fowl
- Domestication
 - ~10,000 years ago
 - Sawai et al 2010
- Intensive selection
 - Began ~1940s
 - Shrader, 1952



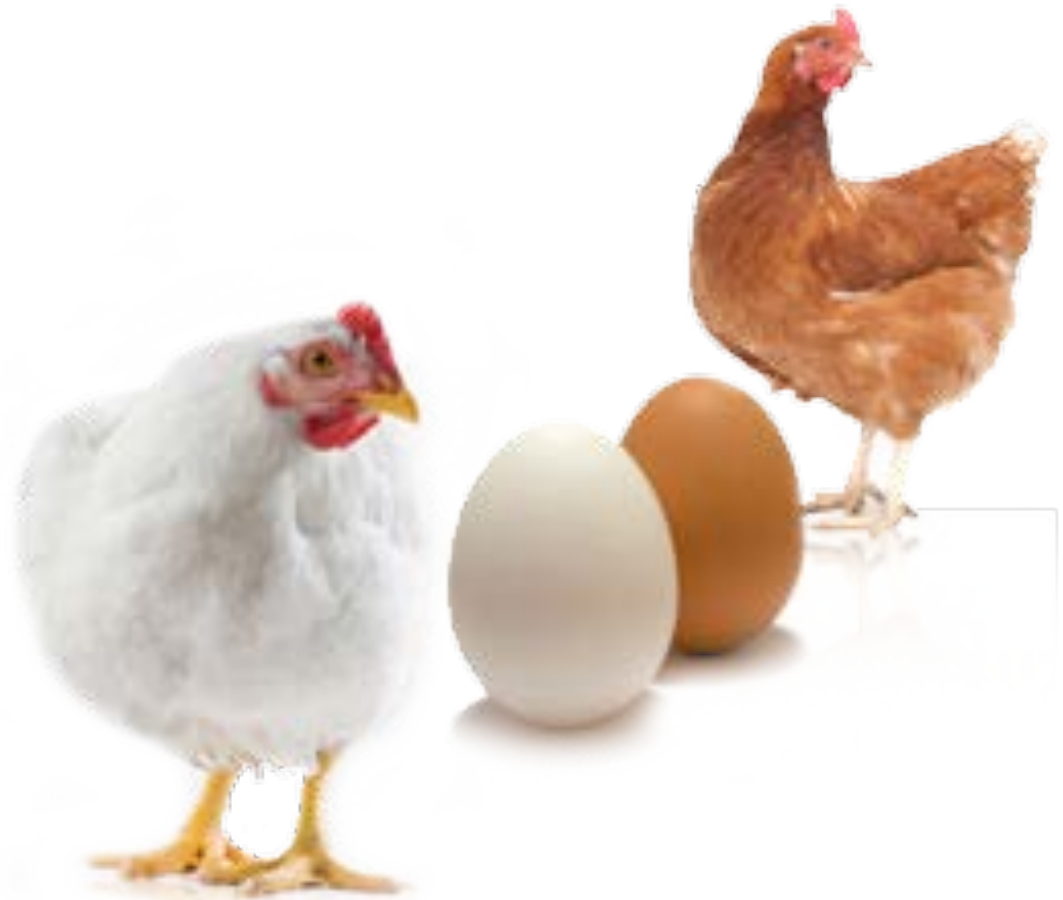
Effects of Domestication on Behaviour

- Reduced fear of humans
- Mainly changes in threshold rather than adding or eliminating behaviours



Motivated Behaviours in the Modern Laying Hen

- Nesting
- Perching
- Foraging
- Dustbathing







Strain Differences in Behaviour



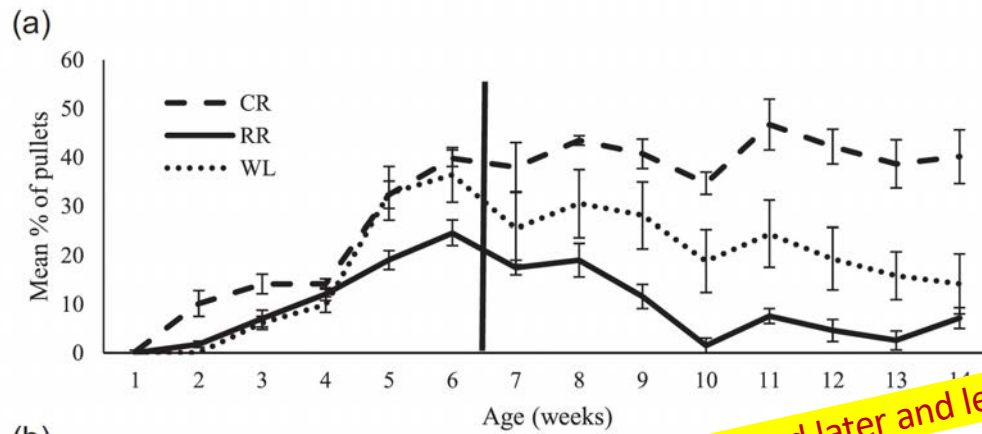
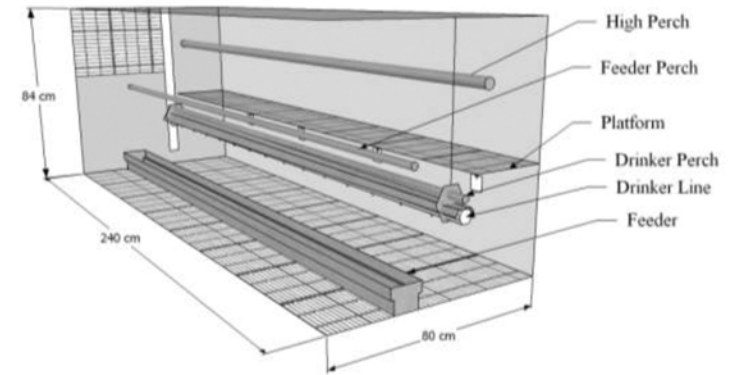
Development of Locomotory Behaviour



Animal Well-Being and Behavior

Development of perching behavior in 3 strains of pullets reared in furnished cages

A.M. Habinski, L.J. Caston, T.M. Casey-Trott, M.E. Hunniford, T.M. Widowski &



(h)

Browns perched later and less



-
- Chicks and pullets trained to climb ramps for reward
 - 2 different Tier heights 70 and 160 cm
 - Ramps at 30⁰, 40⁰, 50⁰, 60⁰, 70⁰
 - 4 strains
 - **Birds walked up inclines at $\leq 40^0$**



Animal (2018), 12:3, pp 585–596 © The Animal Consortium 2017
doi:10.1017/S1751751731117001896



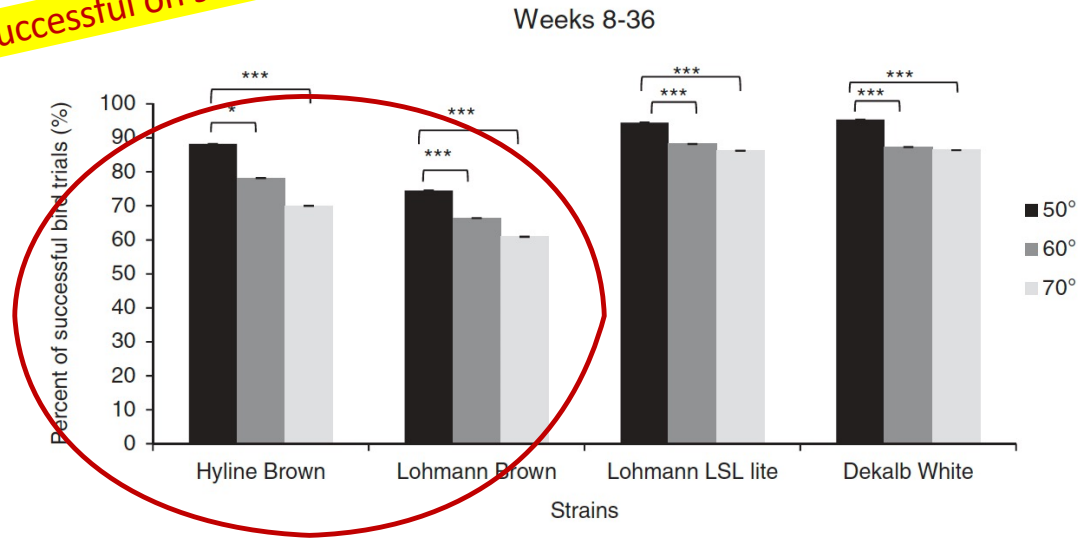
Development of locomotion over inclined surfaces in laying hens

C. LeBlanc¹, B. Tobalske², S. Bowley³ and A. Harlander-Matauschek^{1†}

¹Department of Animal Biosciences, University of Guelph, 50 Stone Road E, Guelph, ON, Canada N1G 2W1; ²Division of Biological Sciences, University of Montana, 32 Campus Drive, Missoula, MT 59812, USA; ³Department of Plant Agriculture, University of Guelph, 50 Stone Road E, Plant Growth Facilities, Guelph, ON, Canada N1G 2W1

(Received 12 October 2016; Accepted 29 June 2017; First published online 7 August 2017)

Browns less successful on steep ramps

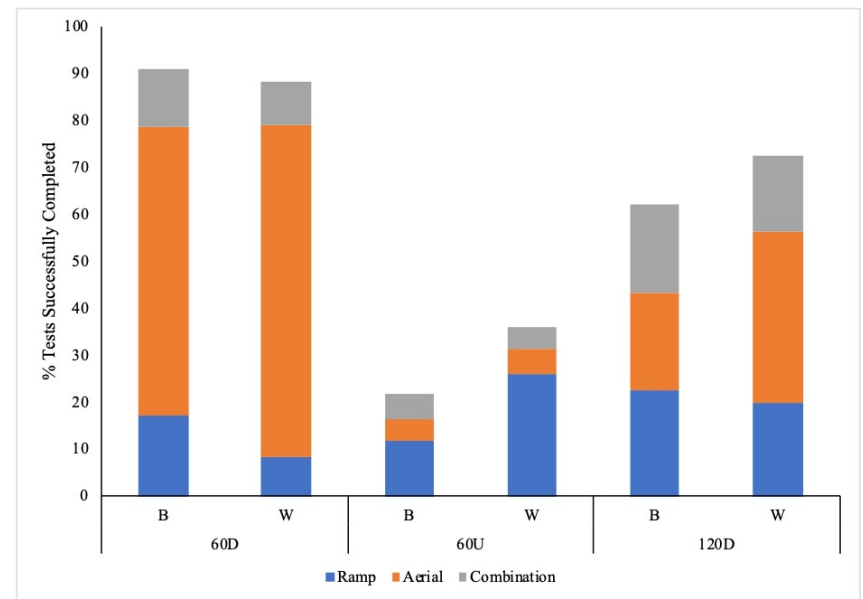
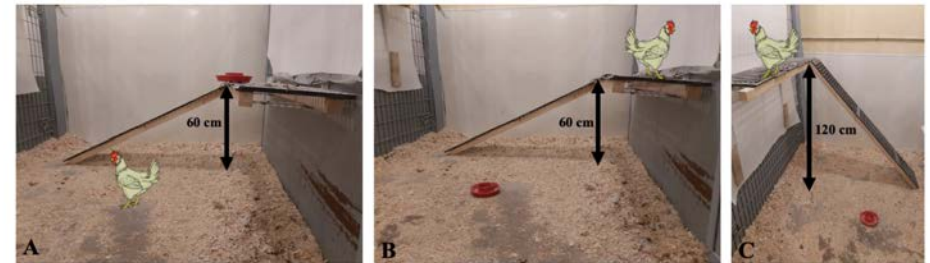


There were strain differences in their abilities to ascend ramps at different inclines

• Leblanc et al., 2018

Strain differences in preference for using ramp

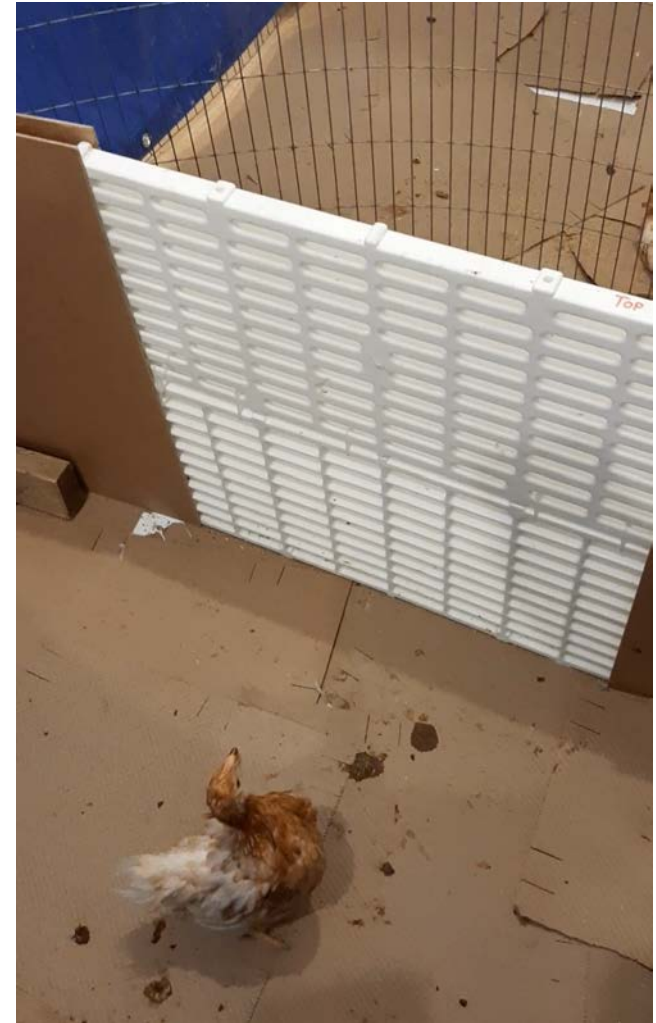
- Tested at 17 weeks to access food reward on platform or on the floor
- White pullets more successful at upwards task
- Whites used the ramp more
- Erin Ross, 2021



Other tests

- **Hurdle jumping**
 - 5 WoA
 - Whites are more successful
 - Browns are affected by rearing environment
- T-maze
 - 13 WoA
 - Whites learn faster than browns
- Activity
 - Brooding phase
 - Whites are more active than browns

Ana Rentsch, 2021



Other tests

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Ana Rentsch, 2021

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Brooding phase
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Ana Rentsch, 2021

Article

Effects of Rearing Aviary Style and Genetic Strain on the Locomotion and Musculoskeletal Characteristics of Layer Pullets


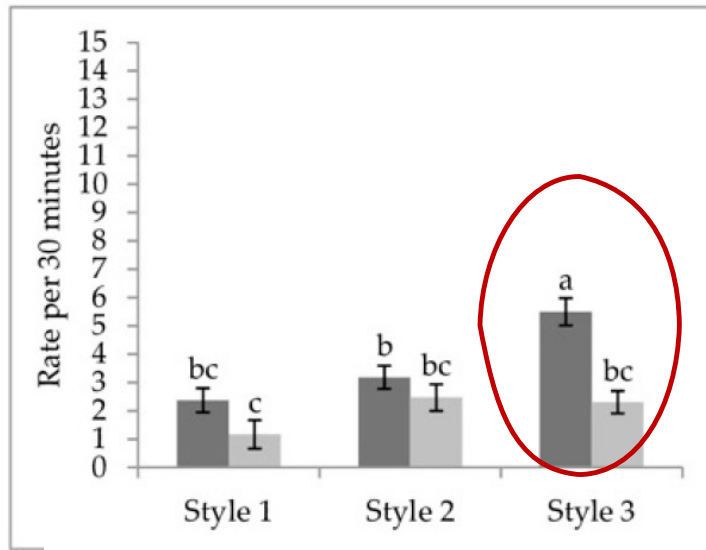
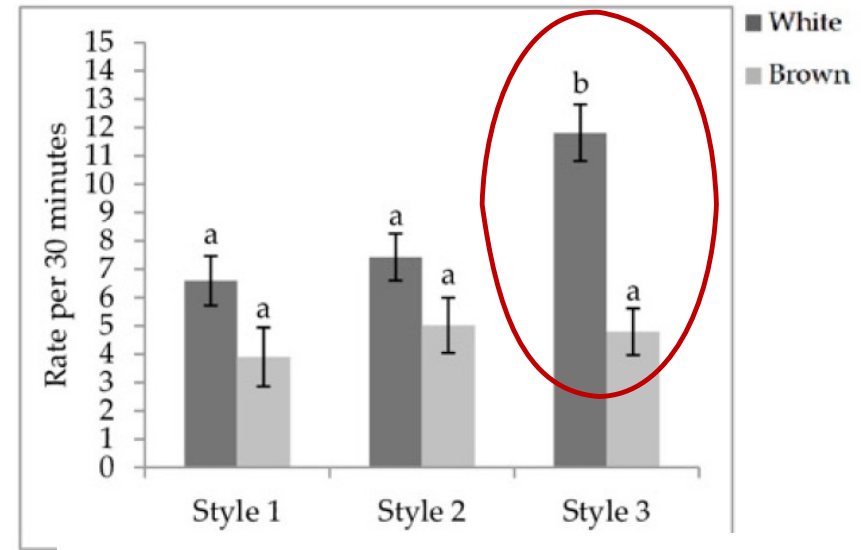
Amanda Pufall ¹, Alexandra Harlander-Matuschek ¹, Michelle Hunniford ² and Tina M. Widowski ^{1,*} 



Photo: Leanne Cooley



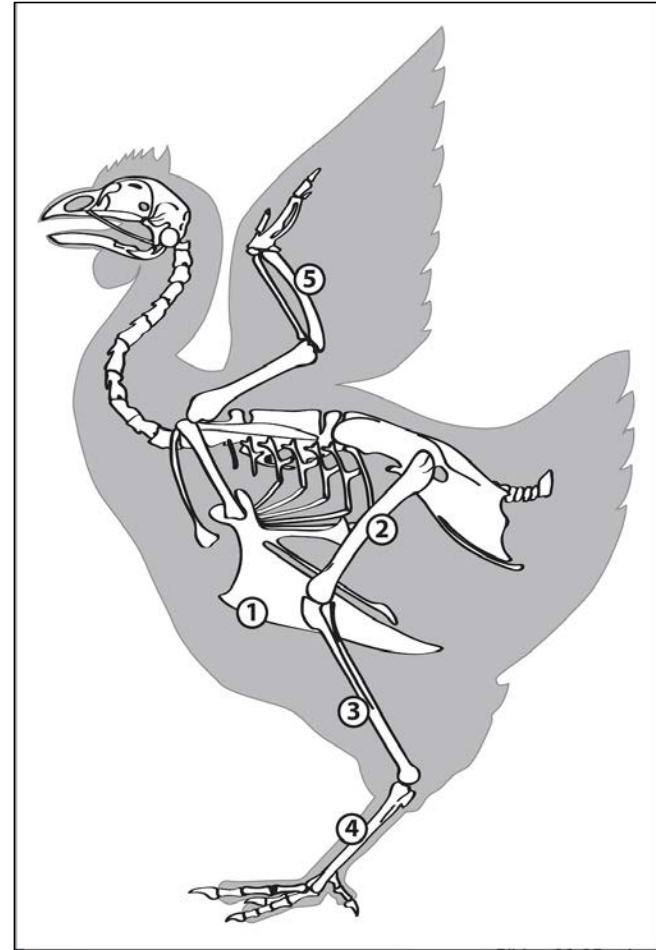
Aerial Transitions
(uses wings to change plane of elevation)



Vertical Transitions
(uses wings + jumps to change elevation)

White strains performed more changes in elevation in an open concept aviary— using wings and jumps

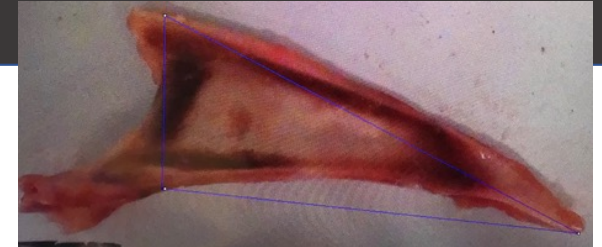
Physique



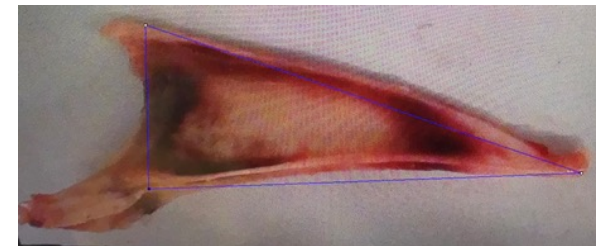
Musculoskeletal differences

- White strains have proportionally larger keels
- White strains have proportionally larger pectoralis muscles
- Brown strains have proportionally larger leg muscle mass

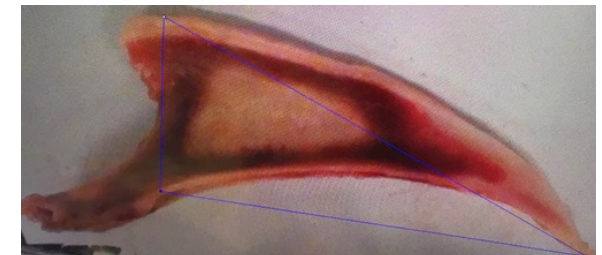
Fawcett et al, 2020; Pufall et al., 2021, Ross, 2021



LSL-Lite



Dekalb White

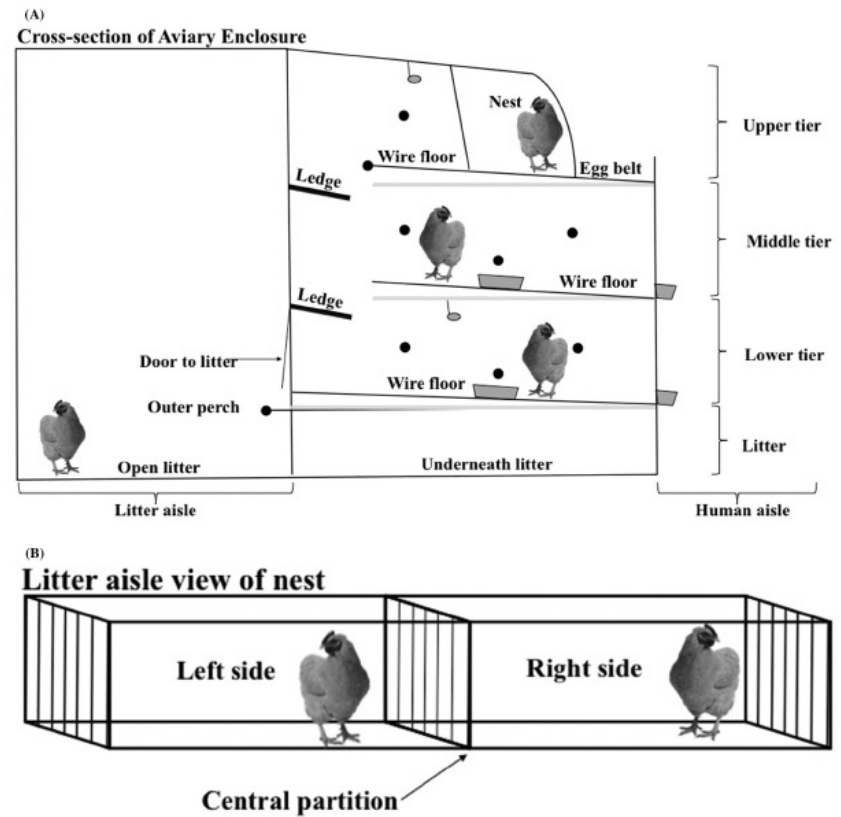


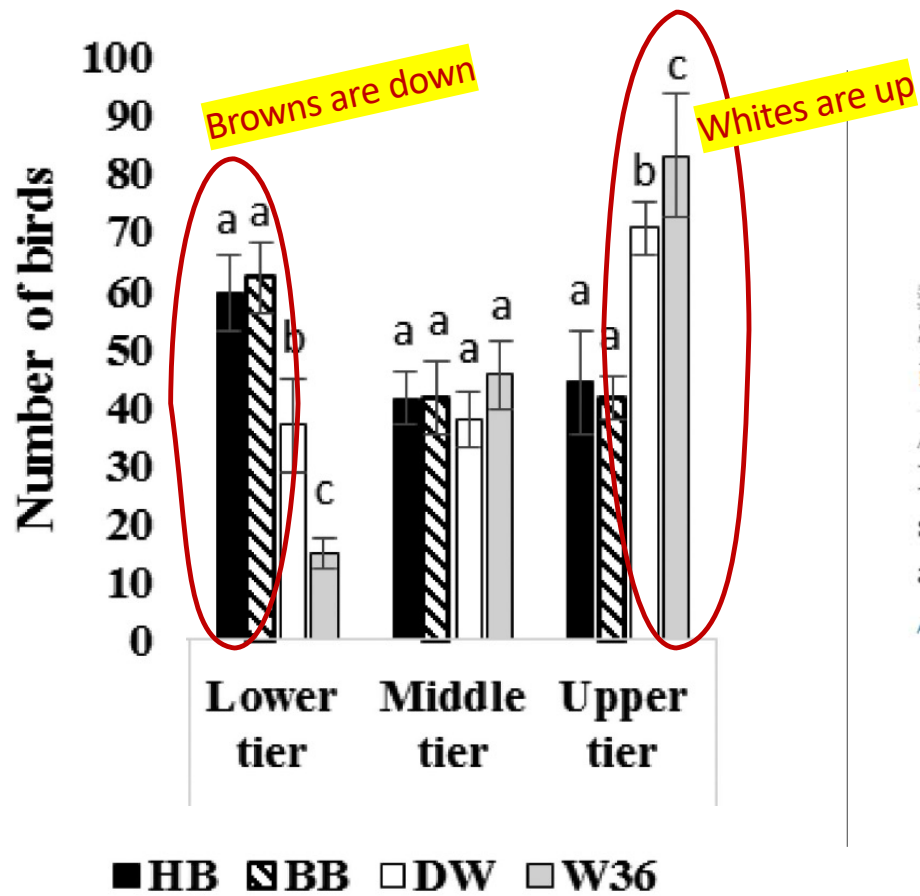
Lohmann Brown

Use of Space and Resources



- Series of studies from MSU
- Compared 4 strains in aviaries
- Hy-Line Brown
- Bovans Brown
- DeKalb White
- Hy-Line W36





Animal Well-Being and Behavior

Influence of genetic strain and access to litter on spatial distribution of 4 strains of laying hens in an aviary system ¹

A.B.A. Ali, D.L.M. Campbell ², D.M. Karcher, J.M. Siegford ²,

Distribution in a 3-tiered aviary during night



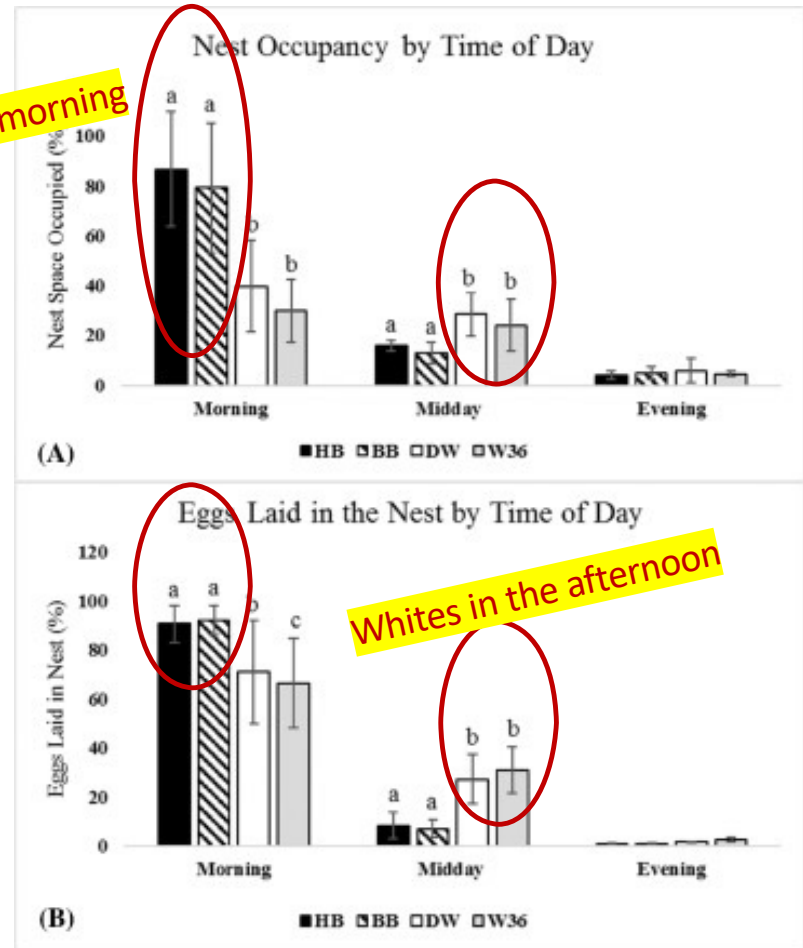
Nest use and patterns of egg laying and damage by 4 strains of laying hens in an aviary system¹

S. Villanueva, A.B.A. Ali, D.L.M. Campbell, J.M. Siegford

Brown preferred the right nest, whites the left

Browns laid more eggs outside the nest and had more damaged eggs

More browns nest in the morning



Whites in the afternoon

Reviews

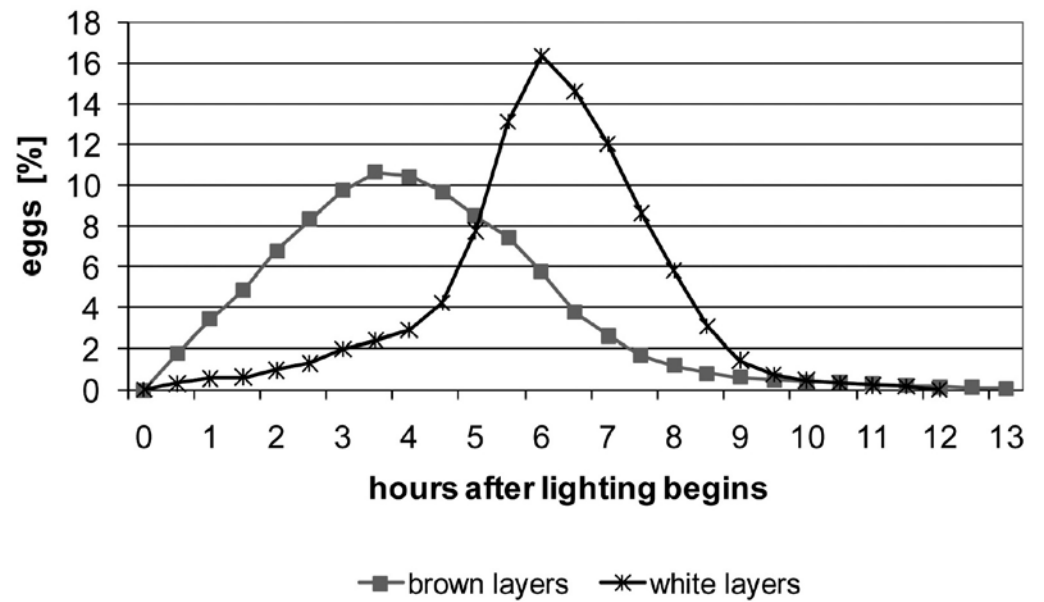
New phenotypes for new breeding goals in layers

W. ICKEN*, D. CAVERO, M. SCHMUTZ and R. PREISINGER

Lohmann Tierzucht GmbH, Am Seedeich 9-11, 27472 Cuxhaven, Germany
*Corresponding author: icken@ltz.de

Table 3 Average oviposition time and duration of stay in the nest for brown and white layers.

Trait	brown layer	white layer
oviposition time	8:00	9:45
duration of stay with oviposition	30 min	45 min
duration of stay without oviposition	10 min	28 min





Animal Well-Being and Behavior

Dust bathing in laying hens: strain, proximity to, and number of conspecifics matter

Tessa C. Grebey *, Ahmed B.A. Ali †, Janice C. Swanson *, Tina M. Widowski †, Janice M. Siegford * & ☒

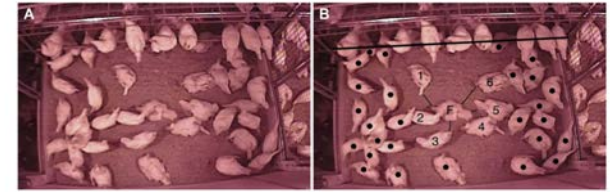


Table 2. Synchronous DB and litter occupancy, DB duration, and average and minimum IBD of focal hens among 4 laying hen strains.

Strain	Number of hens on litter ¹	Number of hens dust bathing simultaneously ²	Average duration (minute) ³	Minimum IBD (cm) ⁴	Average IBD (cm) ⁴
Hy-Line Brown	28.30 ± 8.47 ^a	3.82 ± 3.27 ^a	7.37 ± 6.98 ^a	6.76 ± 3.67 ^a	13.99 ± 4.65 ^a
Bovan Brown	30.97 ± 8.46 ^a	4.04 ± 3.92 ^a	9.00 ± 5.11 ^a	7.35 ± 3.89 ^a	15.12 ± 7.34 ^a
DeKalb White	42.8 ± 8.6 ^b	11.26 ± 3.86 ^b	13.92 ± 8.60 ^b	1.63 ± 2.73 ^b	8.39 ± 3.83 ^b
Hy-Line W36	41.5 ± 6.59 ^b	10.21 ± 3.53 ^b	15.16 ± 8.58 ^b	1.79 ± 1.74 ^b	7.85 ± 3.65 ^b

^{a,b}Data are presented as means ± SEM. Different superscripts indicate statistical significance ($P < 0.05$).

Abbreviations: DB, dust bathing; IBD, interbird distances.

¹Indicates the total number of hens present on the open litter area (i.e., at least one-third of the hen's body is on the outer perch on the open area).

²Indicates the total number of hens DB on the open litter area. (Note: the focal hen is included in the total number of hens on litter and the total number of hens DB.)

³Total duration of the focal hen's DB bout in minute.

⁴Minimum and average IBD in centimeters for each strain.

Whites dustbathe more synchronously, and closer together

Fearfulness and Stress Reactivity



Physiology & Behavior

Volume 228, 1 January 2021, 113185



Effects of acute stressors experienced by five strains of layer breeders on measures of stress and fear in their offspring

Mariana R.L.V. Peixoto ^a, Niel A. Karrow ^a, Amy Newman ^b, Jessica Head ^c, Tina M. Widowski ^a  

 **frontiers**
in Veterinary Science

ORIGINAL RESEARCH
published: 27 March 2020
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Effects of Maternal Stress on Measures of Anxiety and Fearfulness in Different Strains of Laying Hens

Mariana R. L. V. Peixoto ¹, Niel A. Karrow ¹, Amy Newman ² and Tina M. Widowski ^{1*}

¹ Department of Animal Biosciences, University of Guelph, Guelph, ON, Canada, ² Department of Integrative Biology, University of Guelph, Guelph, ON, Canada



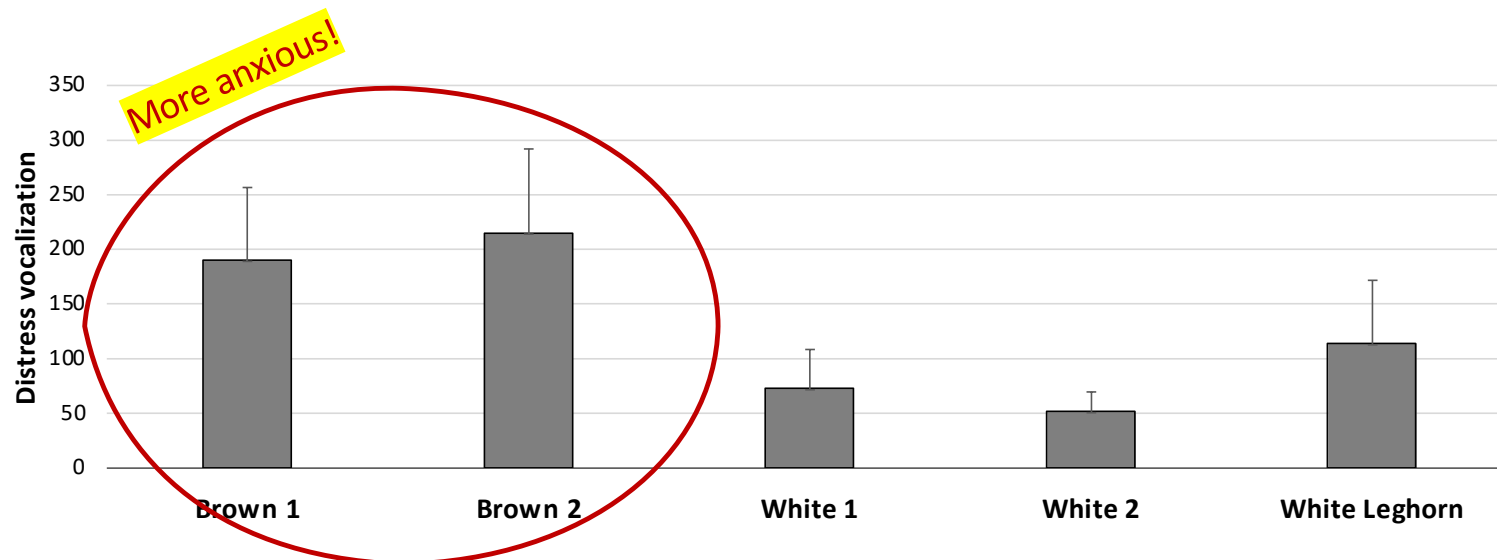
Social Isolation

- Separation from conspecifics produces an increase in distress vocalizations
- More calls = more anxious
- 5 – 10 days of age
- Tested for 5 minutes



Social Isolation

- **Commercial brown** vocalized **more** than **commercial white**. **White Leghorn** was in between.



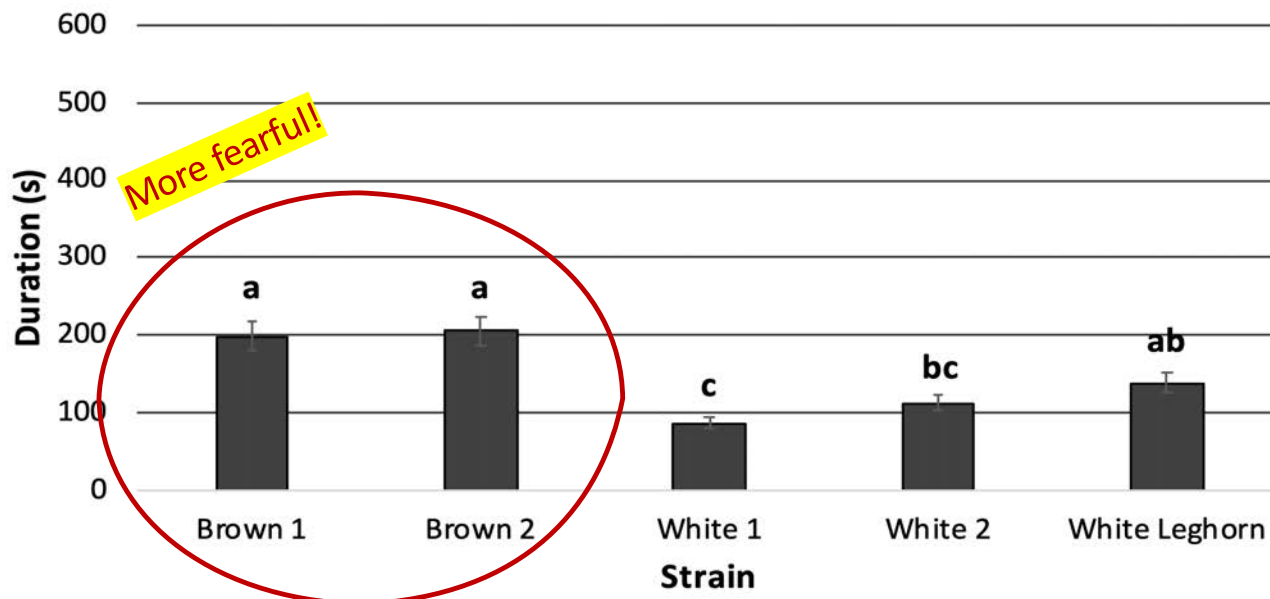
Tonic immobility

- Involuntary response to predation: “death feigning”
- Longer durations = More fear
- Tested at 9 weeks



Tonic immobility

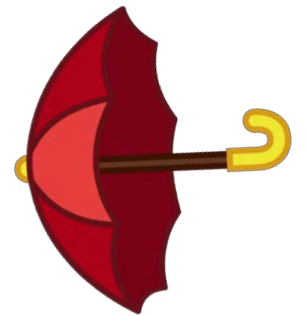
- **Commercial brown** took longer to come out of TI than **commercial white**. **White Leghorn** was in between.





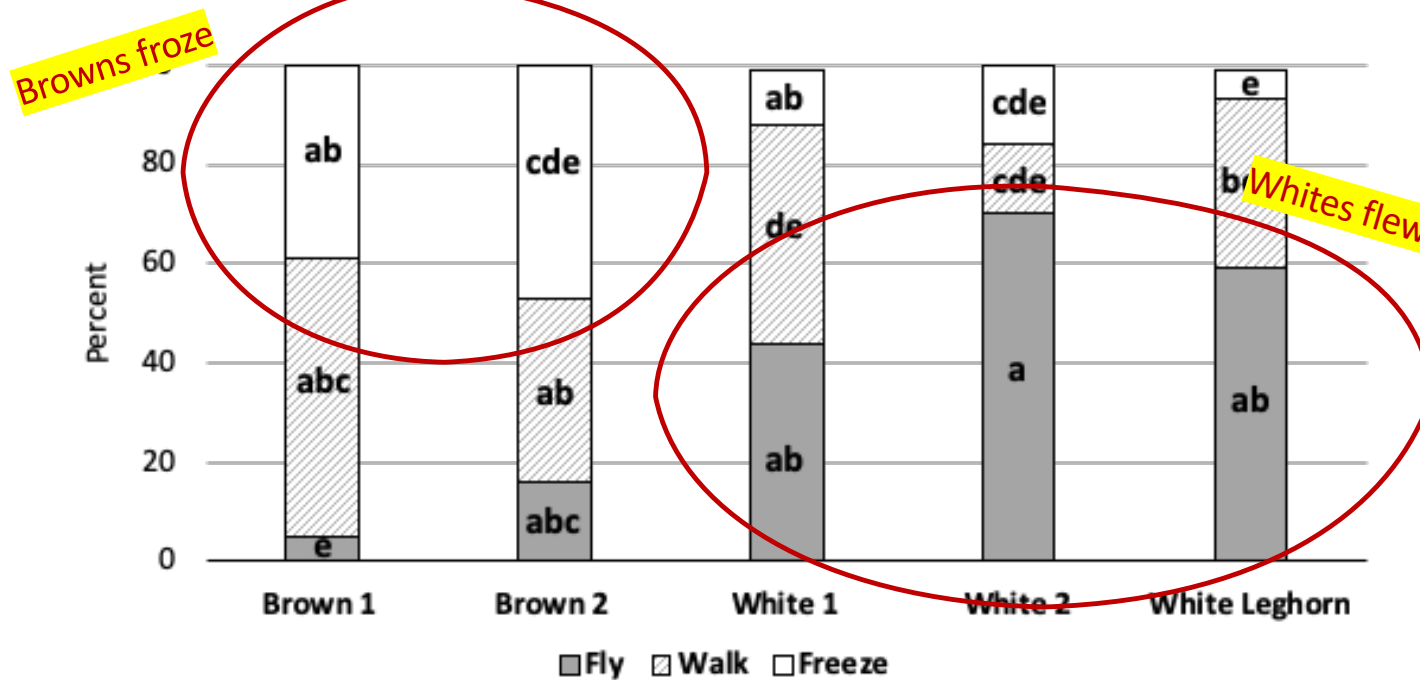
Looming Novel Object

- Response to umbrella opening
 - Freeze
 - Walk
 - Fly
- Tested at 15 weeks



Looming Novel Object

- Commercial brown (86%) froze in response to the umbrella, while white strains (58%) flew away



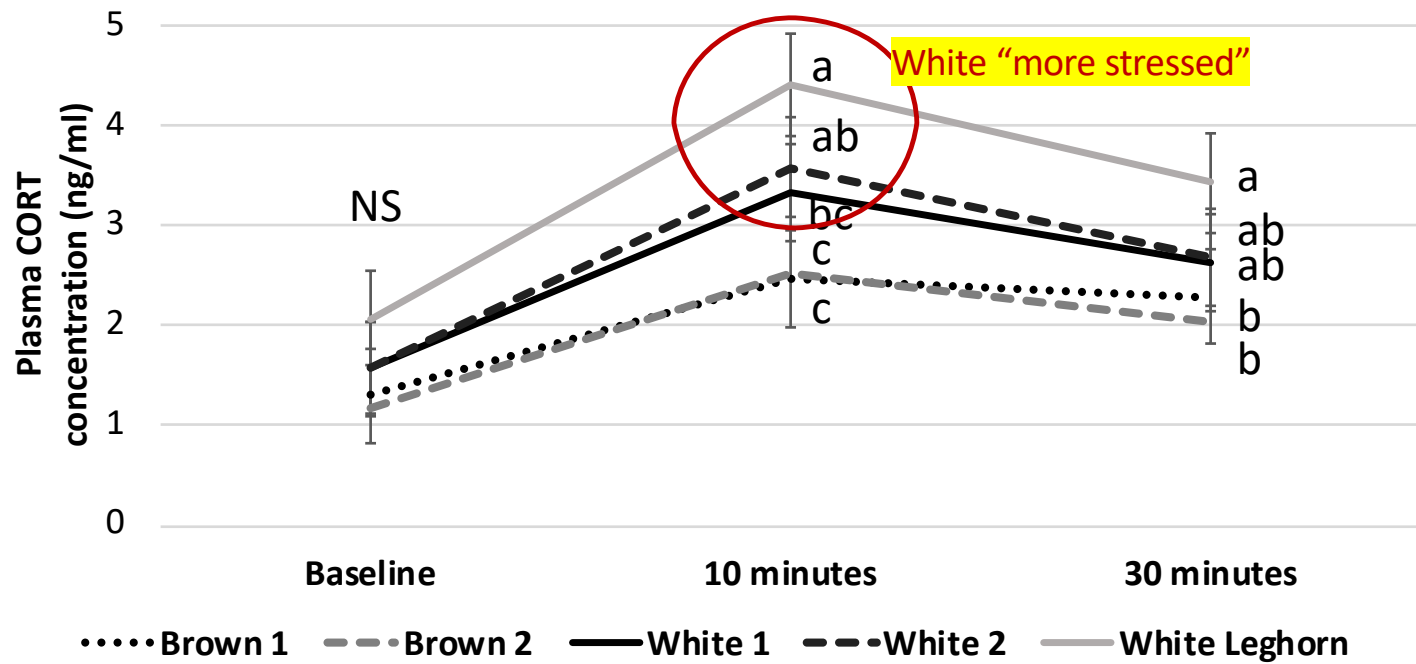
Stress Response during Restraint

3 timepoints:

- Baseline
- Stress response
 - 10 minutes of physical restraint
- Stress recovery
 - 20 minutes of physical restraint



Response to Restraint



Effects of strain

Test	Measure Assessed	Commercial Brown	Commercial White	White Leghorn
Social isolation	Anxiety	↑	↓	↔
Tonic immobility	Fear	↑	↓	↔
Stress response	Behaviour	Freeze	Fly	Fly
Stress response	Physiology	↓	↔	↑

- **Genetic differences** affect **behaviour and stress response** in laying hens

“The” Modern Laying Hen

- For the past 50-60 years brown and white commercial laying hens have been selected mainly for egg production traits
- For the past 50-60 years those same hens have been mainly housed in conventional cages
- We have a lot to learn about differences in their behavioural biology and how this impacts their ‘success’ and welfare in more challenging cage free and aviary housing systems



Venus and Mars

- White hens are 'built' to fly?
- Browns are vertically challenged
 - Physique or motivation?
- Browns need more 'personal space'?
- Whites are 'flightier' when startled, but are they really more fearful than browns?



Acknowledgements



**EGG FARMERS
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