



Beyond the cage: A new era of phenotyping and breeding for laying hens

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Cage-free & (non-)welfare friendly housing

Welfare mismatch: Hope vs reality

- Keel bone fracture
- Feather/Toe pecking
- Piling/Smothering

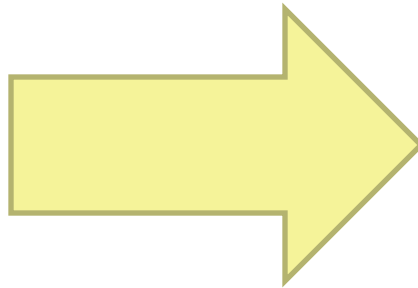


Breeding for cage-free housing (and research)

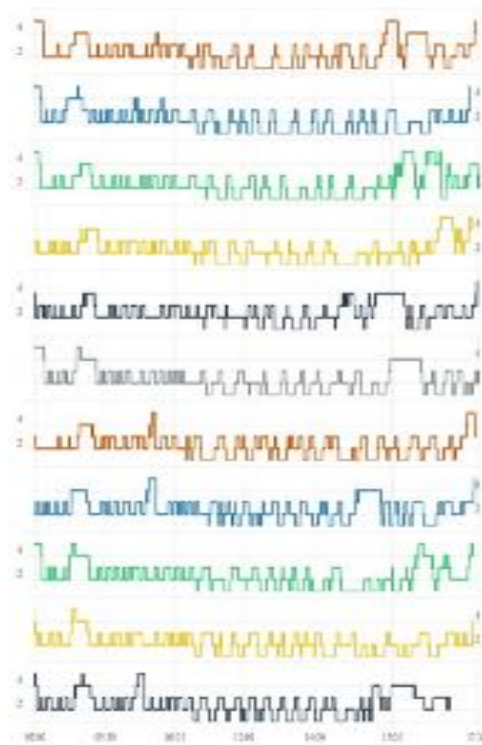
Current methods are based on small groups/individuals



Moving between tiers
(musculoskeletal/cognitive abilities)



Behavioral Structure (Individual profiles)



Article | [Open Access](#) | Published: 17 August 2018

Finding hens in a haystack: Consistency of movement patterns within and across individual laying hens maintained in large groups

[C. Bzdener](#), [I. Perezowski](#), [F. Maximiano Sousa](#), [Y. Ahn](#), [L. Asher](#) & [M. J. Insano](#)

[Scientific Reports](#) 8, Article number: 12303 (2018) | [View this article](#)

HenTrack Aims

- > To provide methodologies for the phenotyping and selection of individual laying hens that perform robustly within cage-free housing systems
- > Partnered with
 - Lohmann Breeders
 - Hendrix Genetics



Advancing the industry

To provide **methodologies** for the phenotyping and selection of individual laying hens that perform robustly within cage-free housing systems

- > Novel methods for the future of breeding
- > Basic research for understanding animal welfare



International stakeholder board

Industry

- 1) Suresh Rayudu Chitturi (Srinivasa Farms Private Limited; Former IEC chair)
- 2) Daniel Würigler (GalloSuisse)
- 3) John R Brunnquell (Egg Innovations)
- 4) André Carreira Carlos (Mantiqueira Brasil)

Academic

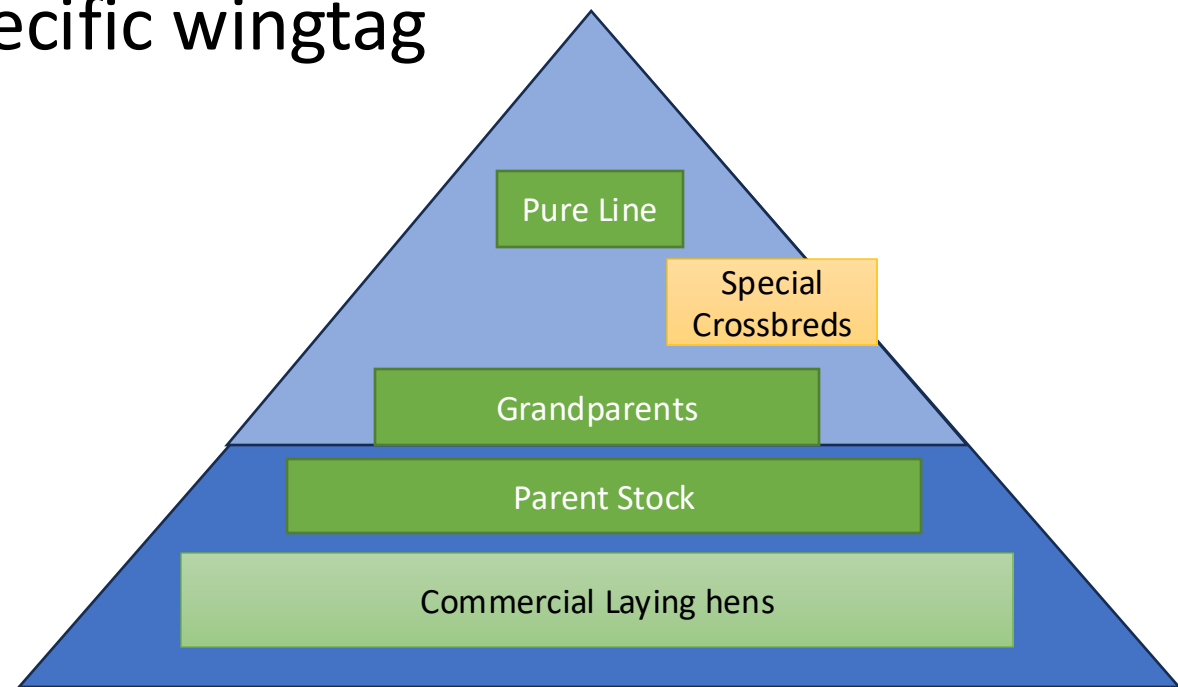
- 5) Inma Estevez (Neiker- Basque Institute for Agricultural Research and Development)
- 6) Leonie Jacobs (Virginia Tech)
- 7) Maja Makagon (UC-Davis)
- 8) Ine Kempen (Antwerp Poultry Research Center)



Methods

4800 hen chicks reared on site (per flock)

- Pure Line matings
- Full and half sibs with sire-specific wingtag
- Hendrix and Lohmann
- 3 flocks (2023-2028)



Methods

Sires				
1	2	3		25
Hen1.1	Hen2.1	Hen3.1		Hen25.1
Hen1.2	Hen2.2	Hen3.2		Hen25.2
Hen1.3	Hen2.3	Hen3.3		Hen25.3
Hen1.4	Hen2.4	Hen3.4		Hen25.4
Hen1.5	Hen2.5	Hen3.5		Hen25.5
Hen1.6	Hen2.6	Hen3.6		Hen25.6
Hen1.7	Hen2.7	Hen3.7		Hen25.7
Hen1.8	Hen2.8	Hen3.8		Hen25.8
Hen1.9	Hen2.9	Hen3.9		Hen25.9

X 5 pens/cross

10 Lohmann pens

10 Hendrix pens

3 flocks (2023 -2028)

Basic data collection

Tracked for entire laying period

- 85-95 WOA
- Now testing in rear as well

Entry/exit into each area for each hen

- Upper tier
- Middle tier
- Lower tier
- Floor
- Wintergarden

Health assessments

- Keel bone fracture (30-45 WoA)
- Feather quality/Toe&foot health (2X; 50-70 WoA)



Additional measures

Specific disease states and movement behavior

- Jens Peter Christensen, U Copenhagen
- Reproductive tract infection and nestbox visits
- Joint inflammation and reduced transitions

Causal genetic variants of welfare related traits

- Pascal Duenk and Martin Derks, Wageningen U
- Improved understanding on the genetic background of welfare-related behaviors
- Benefits of prioritizing such variants in breeding value estimation and genetic selection

Neurogenesis as an indicator of affective states

- Tom Smulders, Newcastle U

Piling behaviour

- Peta Taylor, Melbourne U
- Social genetics effects
 - Juan Steibel, Iowa State U

Neural plasticity and the microbiome

- Anat Barnea & Janja Siróvnik, Open University Israel/Vetmed Uni



Get on the HenTrack train!



6/2/2025

Results so far . . . Durations

		σ^2_e	σ^2_a	Σ^2_{pe}	h^2 (%)	Re
 Zone 5: Highest Tier Feed, water, perches <i>Nighttime roosting</i> Zone 4: Middle Tier Nestboxes, perches Zone 3: Lowest Tier Feed, water, perches Zone 2: Floor Litter Zone 1: Wintergarden Water, perches		40,901.3	5,779.5	13,867.1	9.5 (1.7)	32.4 (1.0)
		292.8	42.5	36.4	11.4 (1.4)	21.2 (0.9)
		29,034.0	1,919.5	5,308.1	5.2 (1.0)	19.9 (0.7)
		5,805.7	3,402.5	3,151.0	27.5 (3.2)	53.0 (1.3)
		722.3	103.1	235.3	9.7 (1.8)	31.9 (1.0)



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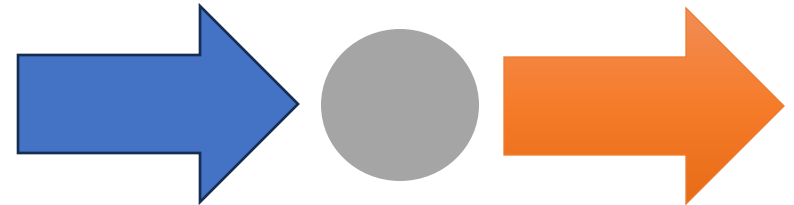


Genetic parameter estimates for the use of
an aviary with winter garden by laying hens

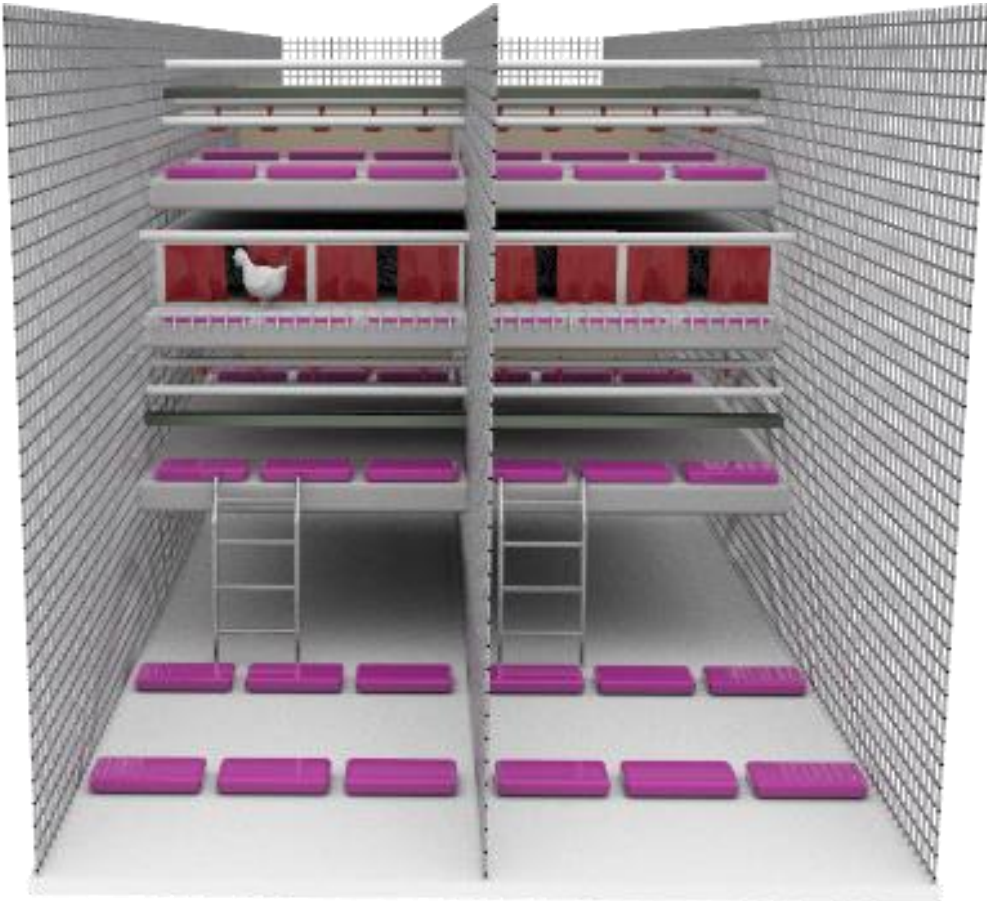
Bayode O. Makanjuola ^{*}, Sabine G. Gebhardt-Henrich [†], Michael J. Toscano [†],
Christine F. Baes ^{* †}  

A new age of breeding metrics

- Far greater resolution and detail
- Egg size, body mass, Movement predictability?
- Proxies when direct measures are not possible
 - Disturbing birds with invasive procedure (bone fracture)
 - Difficulties to see (feeding)
- Indicators of:
 - Disease/injury/poor welfare
 - Style/ability to recover

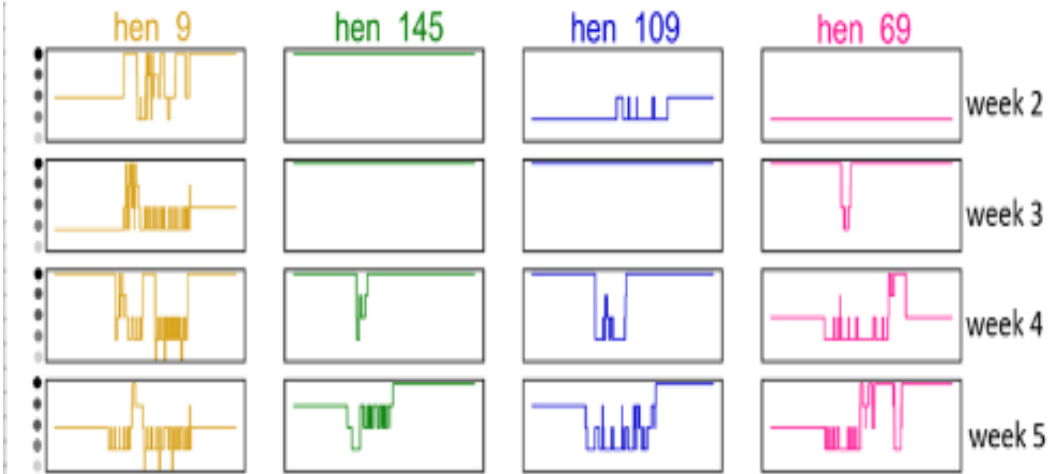


New Phenotypes



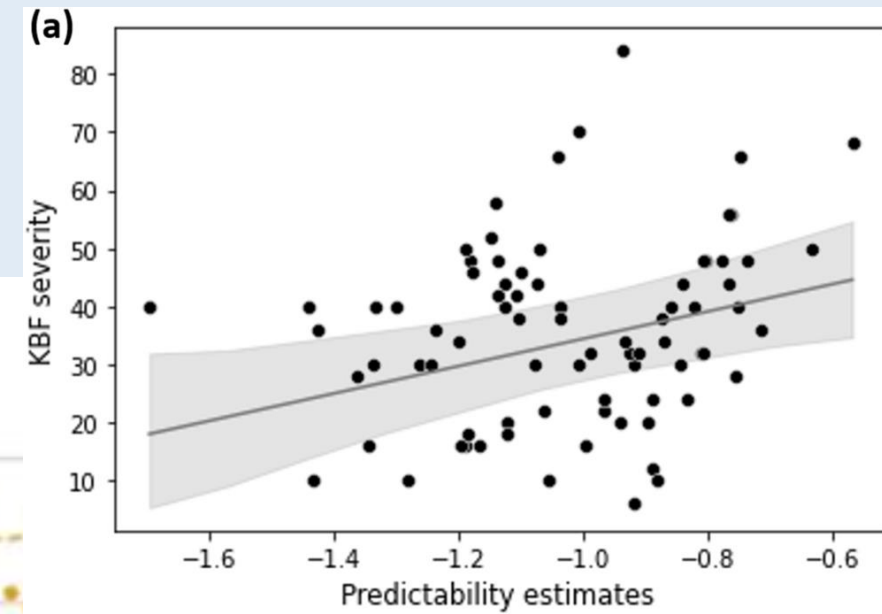
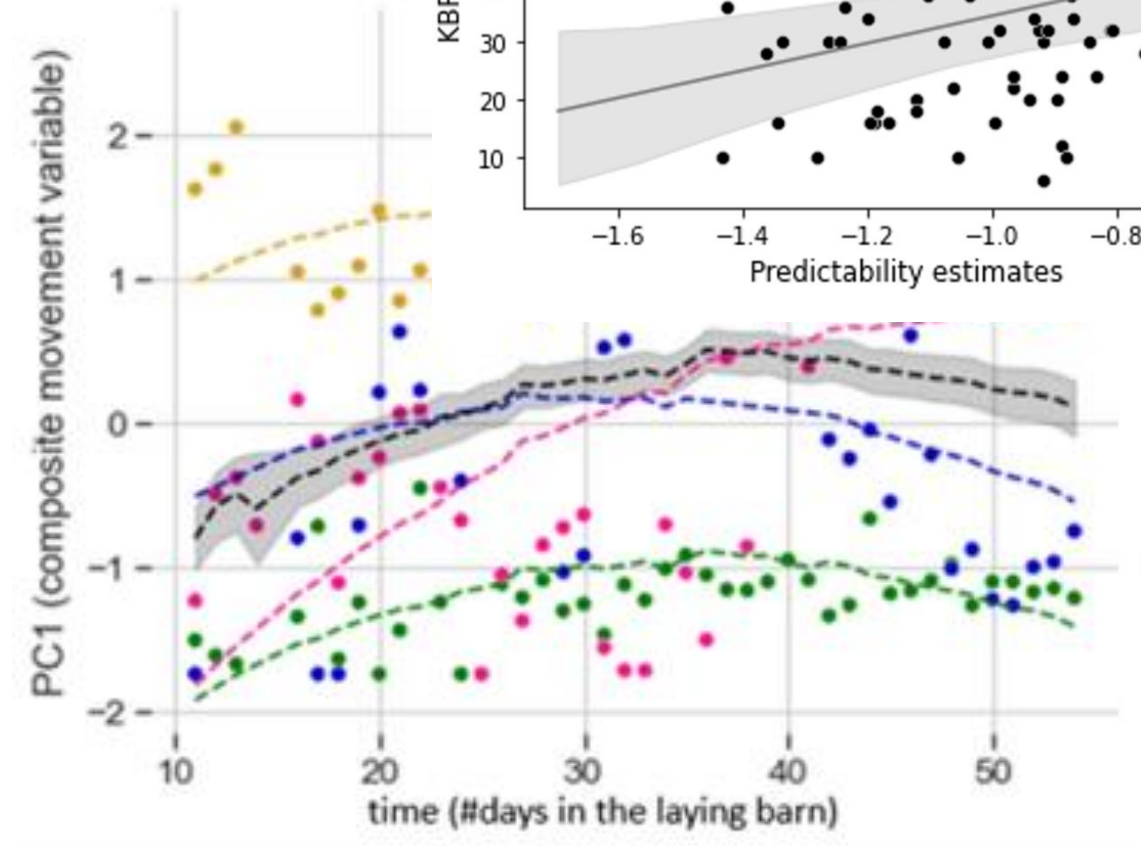
Antennae/Zone
Time/Date

Metrics of variation



Daily (movement)

- Duration in each zone
- Transitions in each zone
- Vertical distance per hour
- Wintergarden use (0-15 min)
- Sleeping position



Montalcini, C.M., *et al.* Intra-individual variation . . . *Sci Rep* **13**, 2377 (2023).
<https://doi.org/10.1038/s41598-023-29587-9>

New phenotypes – Proxies

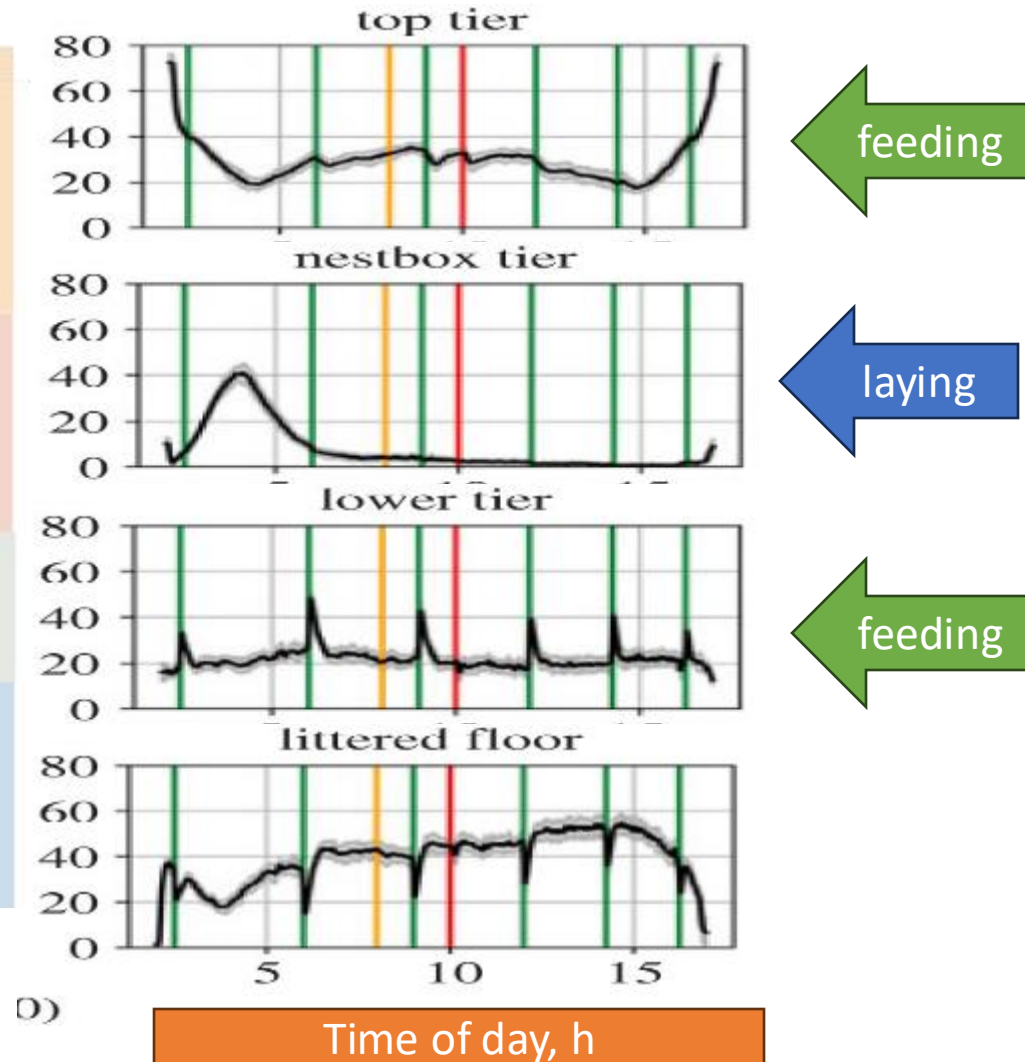


Zone 5: Highest Tier
Feed, water, perches
Nighttime roosting

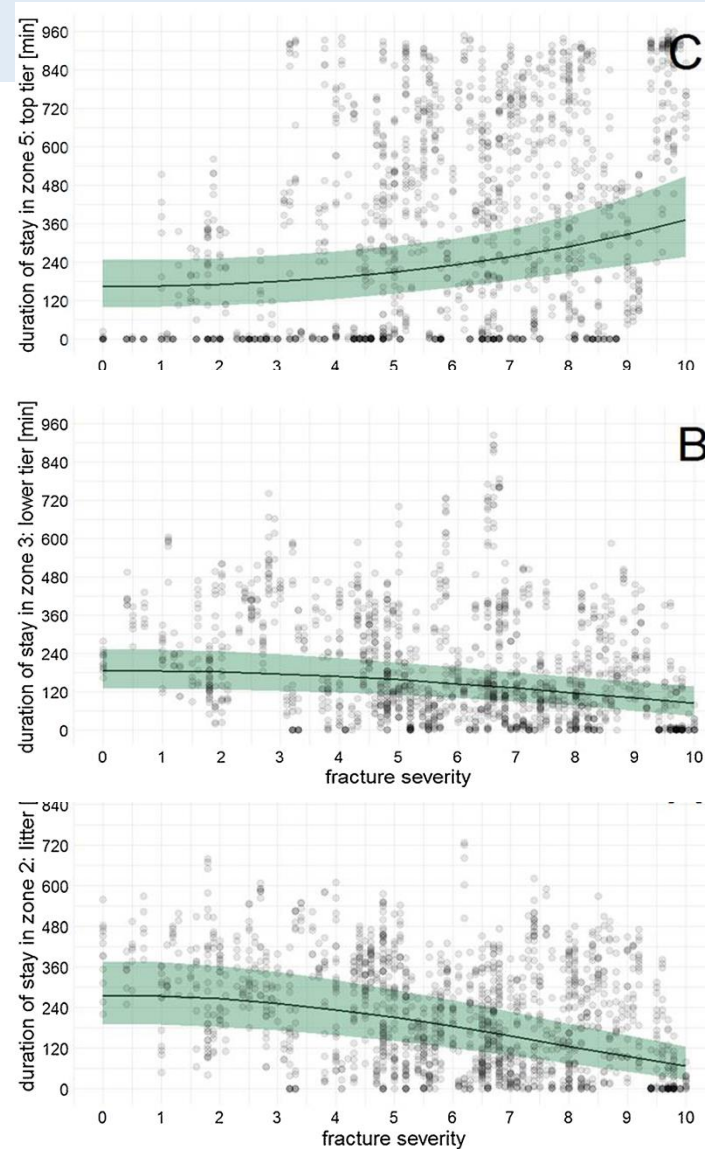
Zone 4: Middle Tier
Nestboxes, perches

Zone 3: Lowest Tier
Feed, water, perches

Zone 2: Floor
Litter



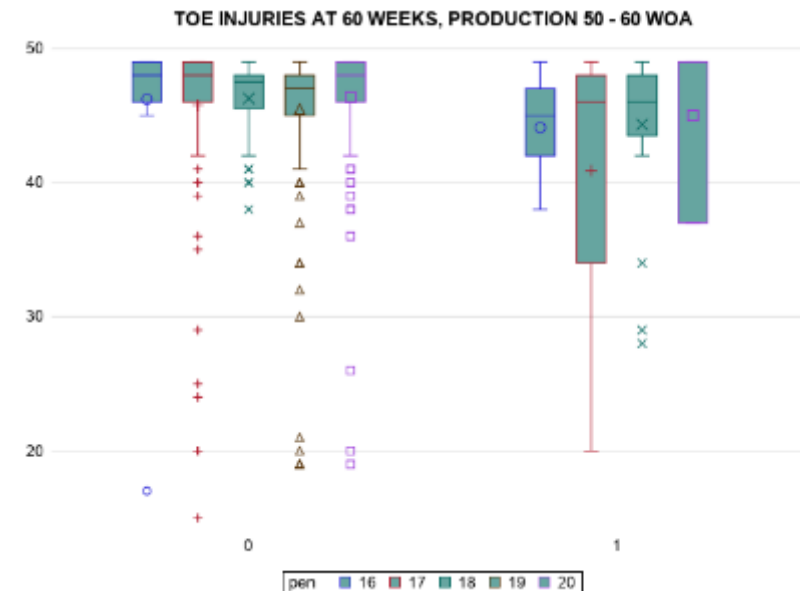
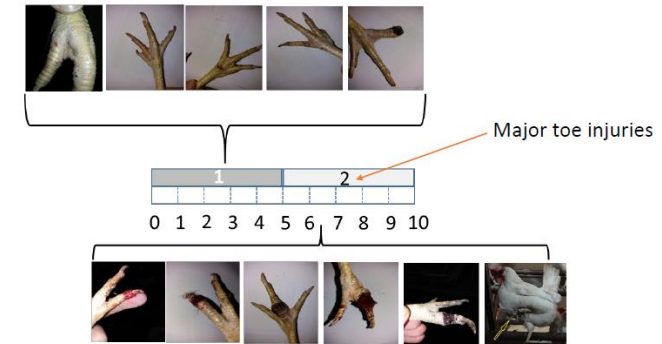
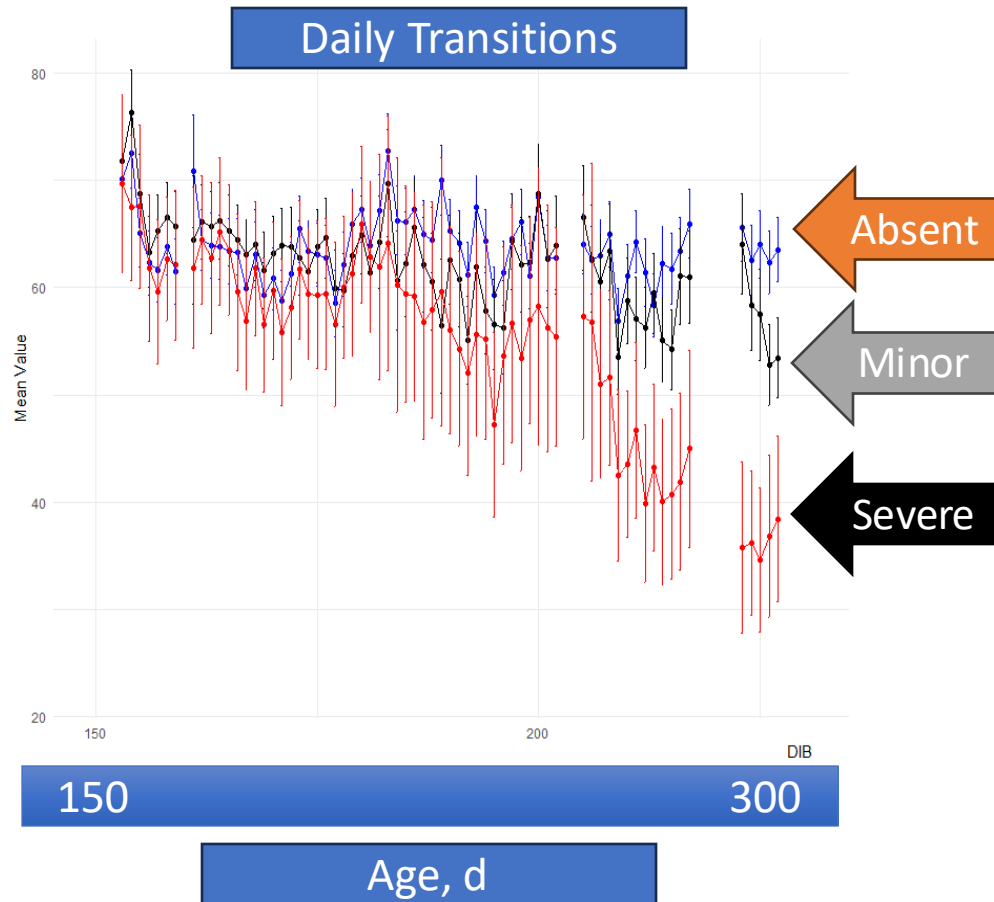
Refuges as phenotypes



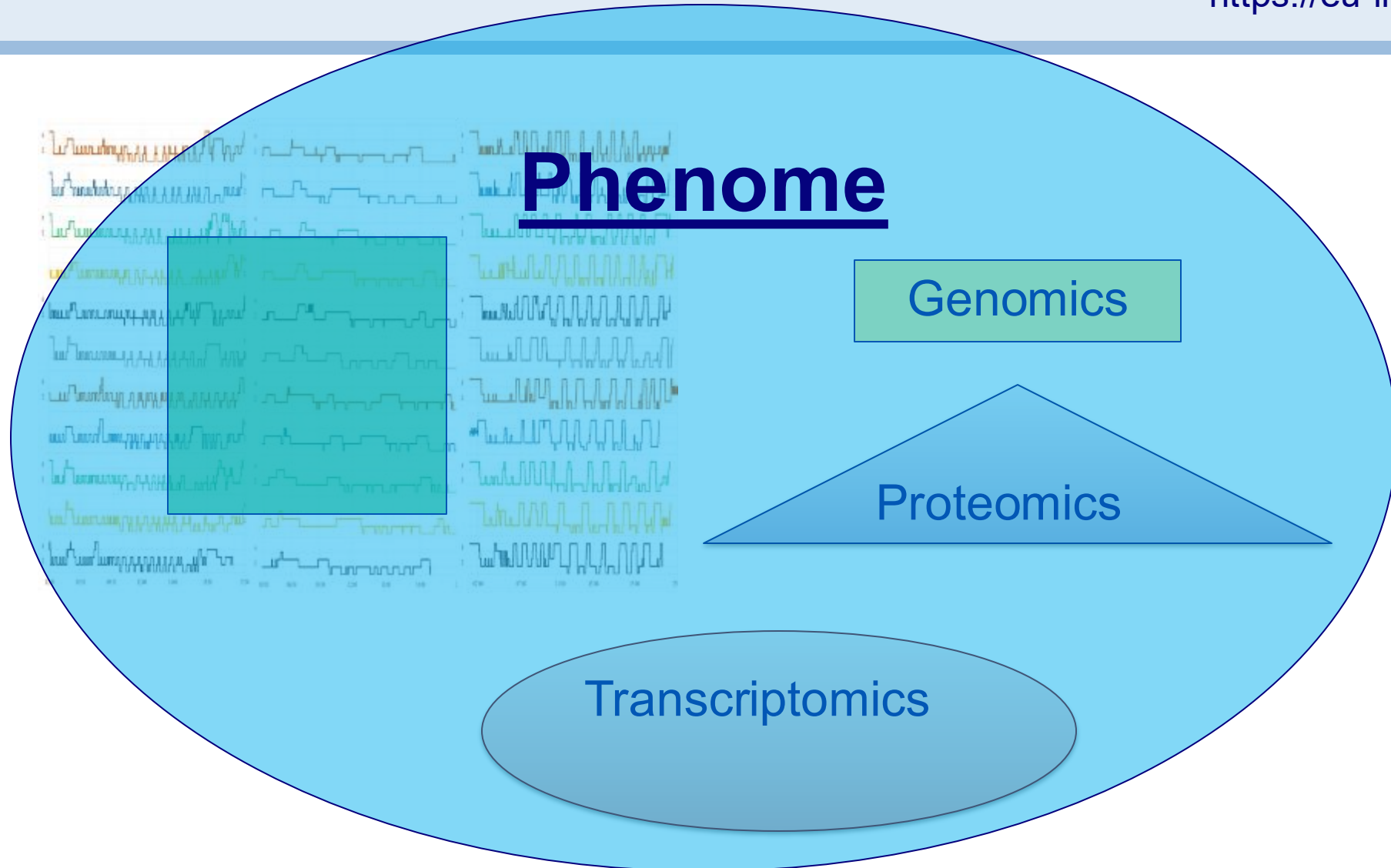
Toe injuries:

Movement

& Egg production (proxy)



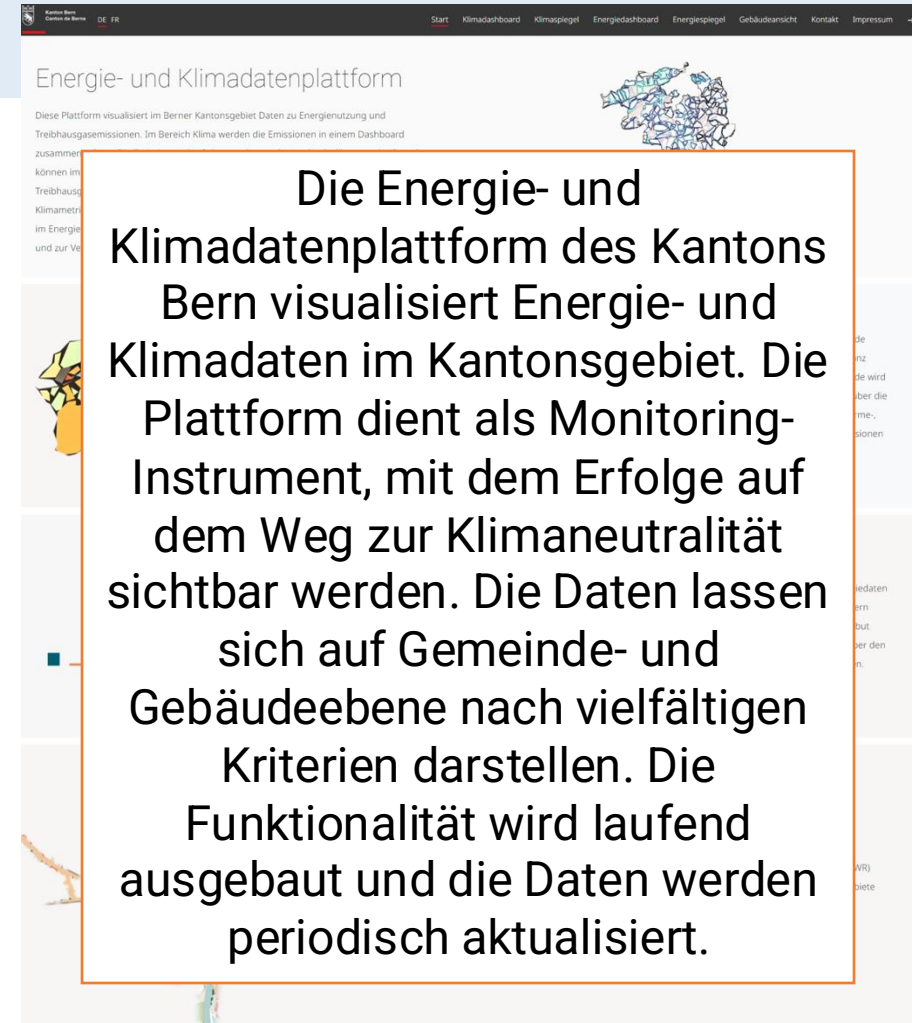
A important part of the phenome



Better use of Big Data

University of Bern Digitalization Strategy (DigiK)

- WP1
 - Building a searchable, publicly accessible, database (S Haug)
 - Containing all HenTrack and related project data
 - Tracking
 - Health measures
 - Full genome
 - Field test data
 - Embedded visualization tools (M Stürmer)
- WP2
 - Basic data exploration



Better use of Big Data

University of Bern Digitalization Strategy (DigiK)

- Funding for workshops to provide training on use of the platform
- Development of templates
- COST deliverable for WG 3
 - 3.: A document/report including (a) proposal(s) to establish standardized databases and computational procedures



About the Action

EU-LI-PHE will create a Europe-centered multidisciplinary community of experts that will enhance scientific collaboration, catalyze developments, and transfer **livestock phenomics** concepts and applications to improve the sustainability of the sector.

Many thanks

All ZTHZ, past and present

- Sabine Gebhardt
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- Swiss National Science Foundation
- Australian Eggs
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- The Open Philanthropy Project
- Egg Industry Center
- Hendrix Genetics
- Lohmann Breeders

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- Bram Visser
- Jeroen Vischer

Questions?

