Animal resilience:
Health, Disease & Animal centred husbandry systems

Ingrid van Dixhoorn, Kees van Reenen, Jan ten Napel, Fleur Hoorweg (WLR)
Simon van Mourik (ABE),Liesbeth Bolhuis (ADP), Annemarie Rebel (ADP, WBVR)

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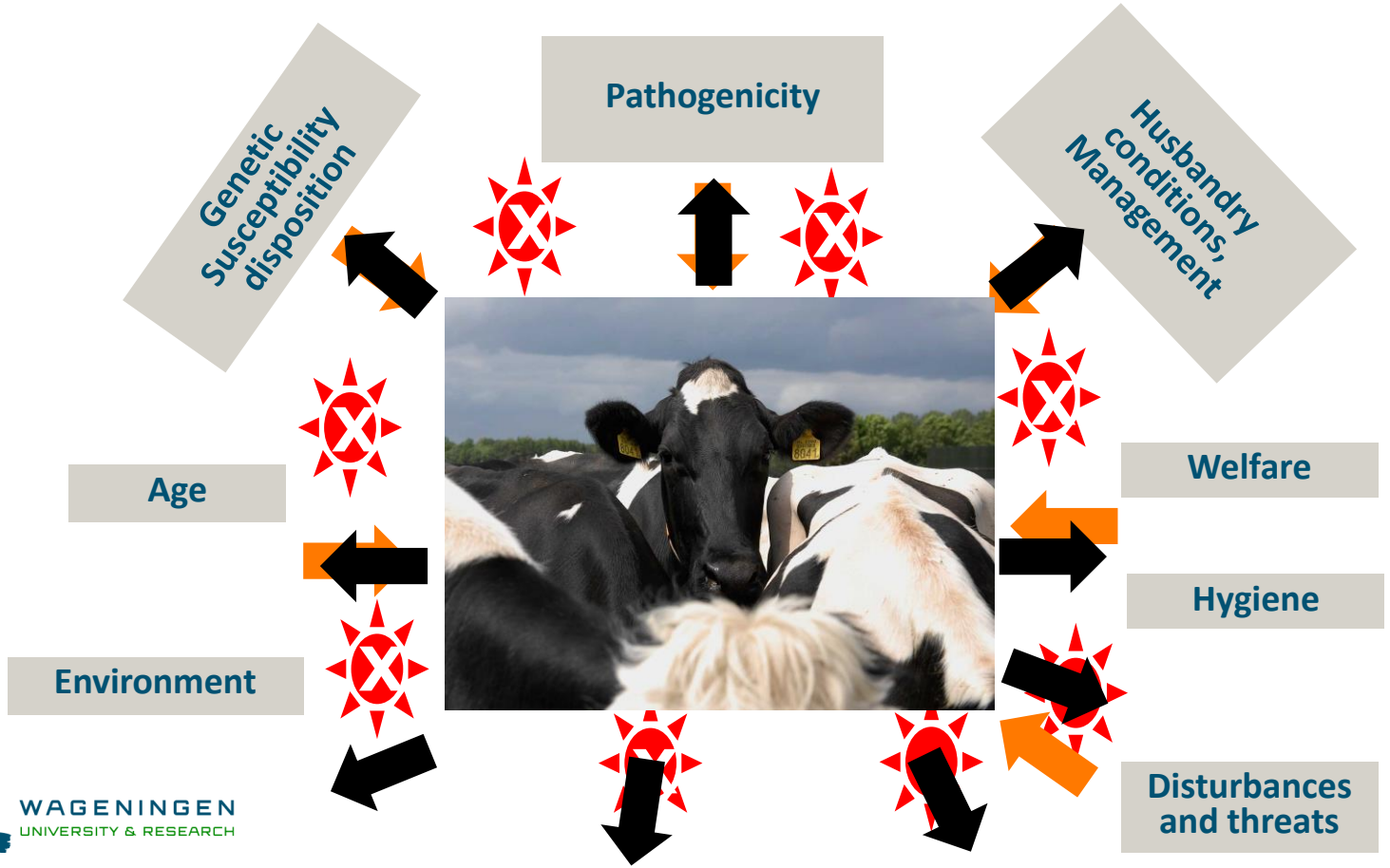
Control -> Adaptation



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How to operationalise animal resilience

BEFORE CHALLENGE

Challenge

AFTER CHALLENGE

Influencing factors

(Dynamic) Indicators Of Resilience

Response

Consequences

Animal factors

External factors

Animal state

Proxies of resilience

Influence

Measure

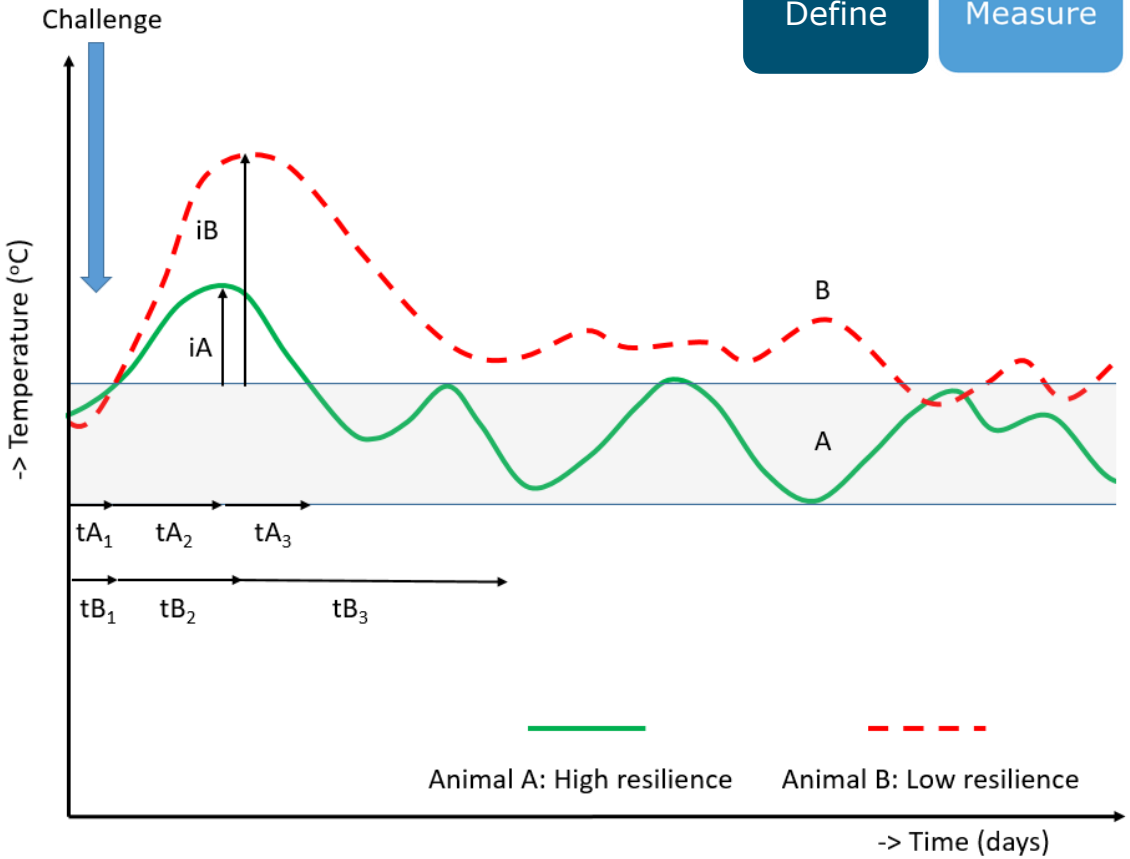
Define

How to assess resilience (response after challenge)

Define | Measure

Temperature example

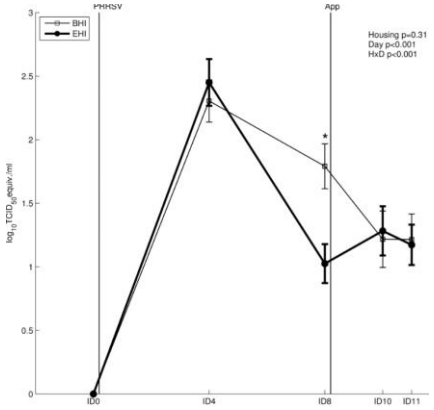
- Degree of response
- Recovery time
- Level after recovery



Examples of proxies of disease resilience

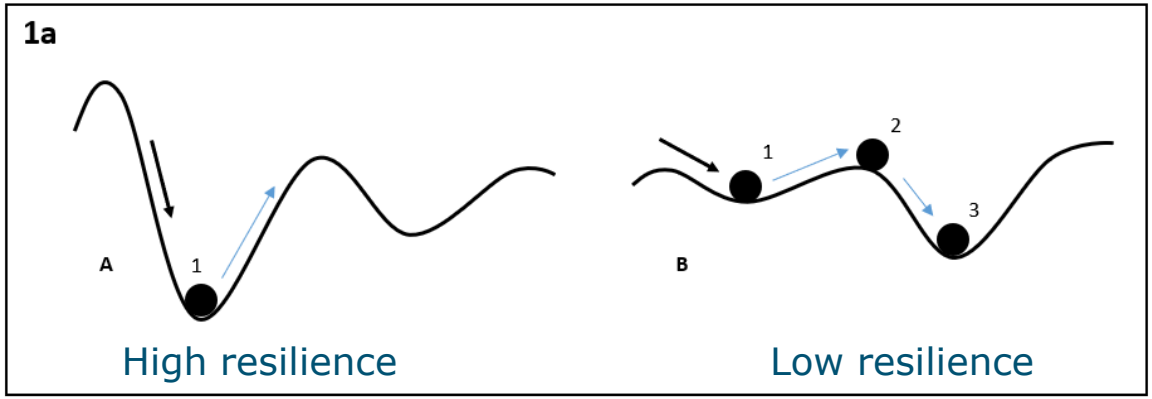
Measure

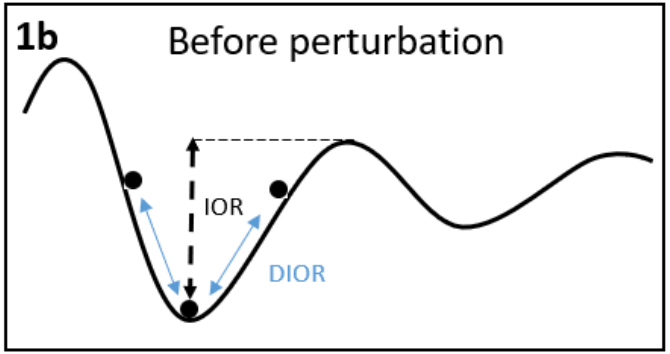
- Body Temperature
- Viral clearance
- Pathological findings
- (Sickness) behaviour
- Longevity
- Morbidity
- Total Deficit Score (TDS)



Stability landscapes

Define | Measure





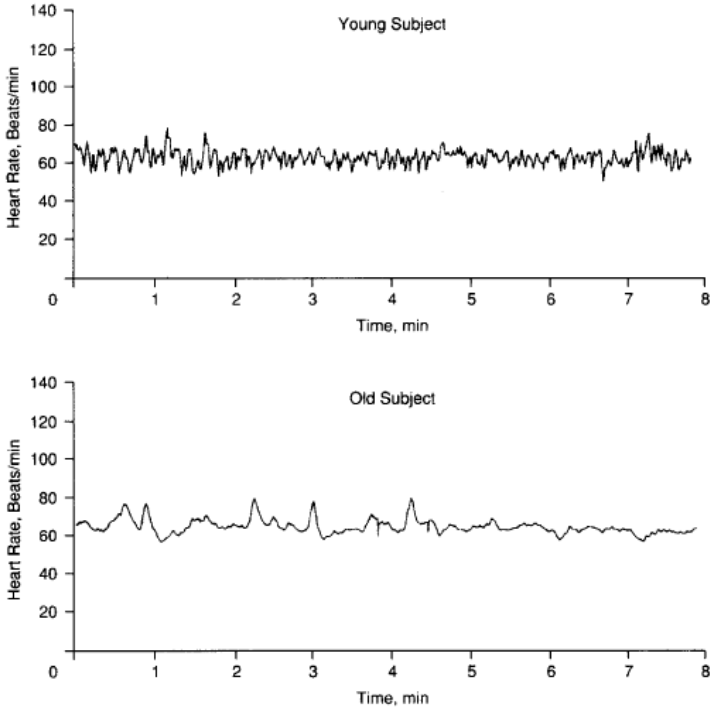
(Dynamic) Indicators of Resilience
Before challenge
(D)IORS

Measure

Dynamics of variables reveal more information

Average Heartbeat/min
young person 64.7; SD 3.9 old person 64.5; SD 3.8

Lipsitz & Goldberger, 1992



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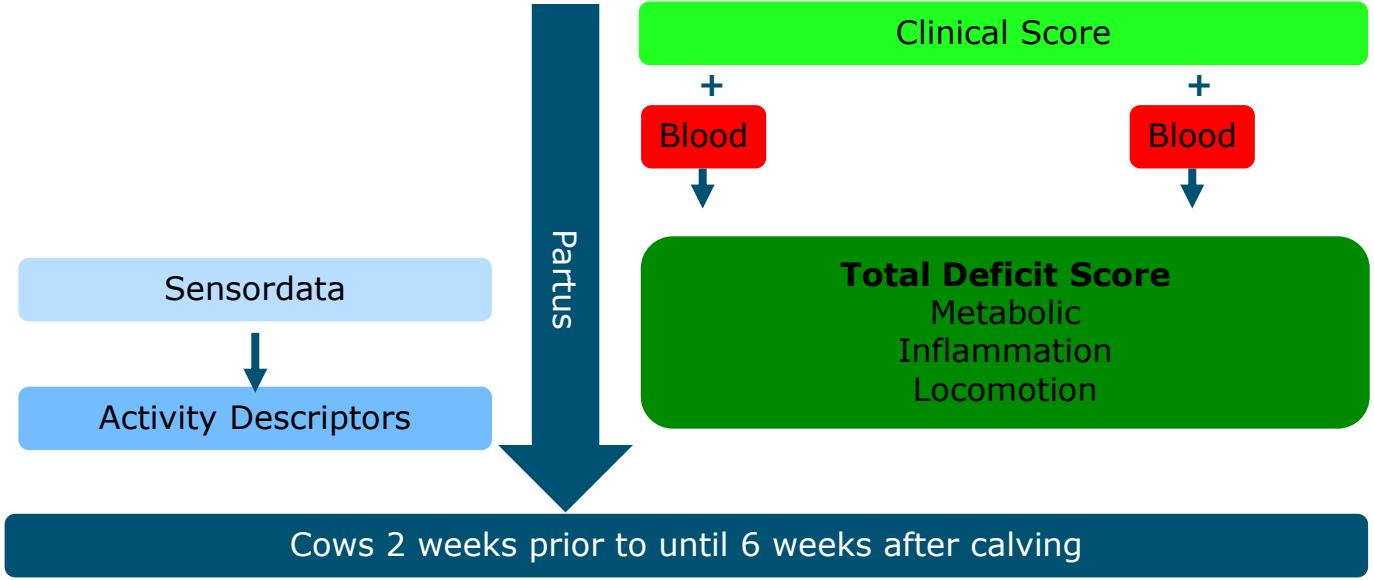
DIORs in dairy cows (185 cows, scored 'healthy' in dry period)



van Dixhoorn, I. D. E., R. M. de Mol, S. K. Schnabel, J. T. N. van der Werf, S. van Mourik, J. E. Bolhus, J. M. J. Rebel, and C. G. van Reenen. 2023. **Behavioral patterns as indicators of resilience after parturition in dairy cows**. Journal of Dairy Science., https://doi.org/10.3168/jds.2022-22891

More resilient cows

Measure

- Higher variance of ear temperature
- More active, eat and ruminate more
- Distinct active periods, alternated with resting periods in **regular diurnal patterns**
    - To be able to live a regular life may pr
      dairy cows
- Sensordata can help to detect cows at risk

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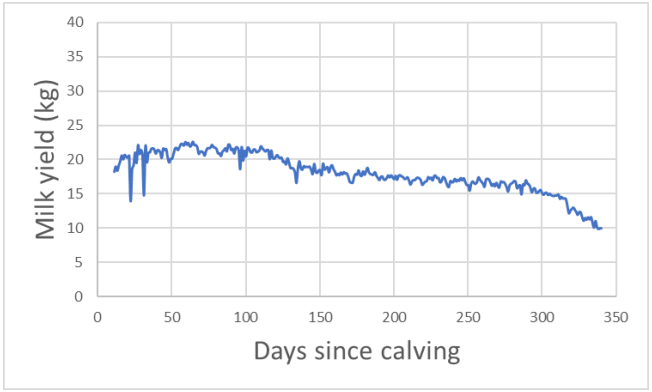
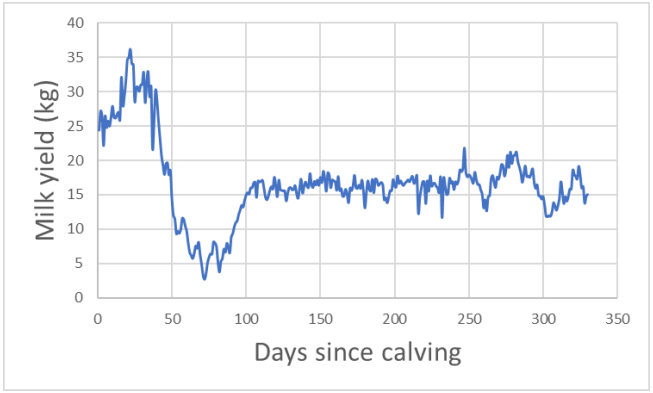
Daily milk yield fluctuations

Measure





Low variance
&
Low autocorrelation

Resilient

High variance
&
High autocorrelation

Not resilient

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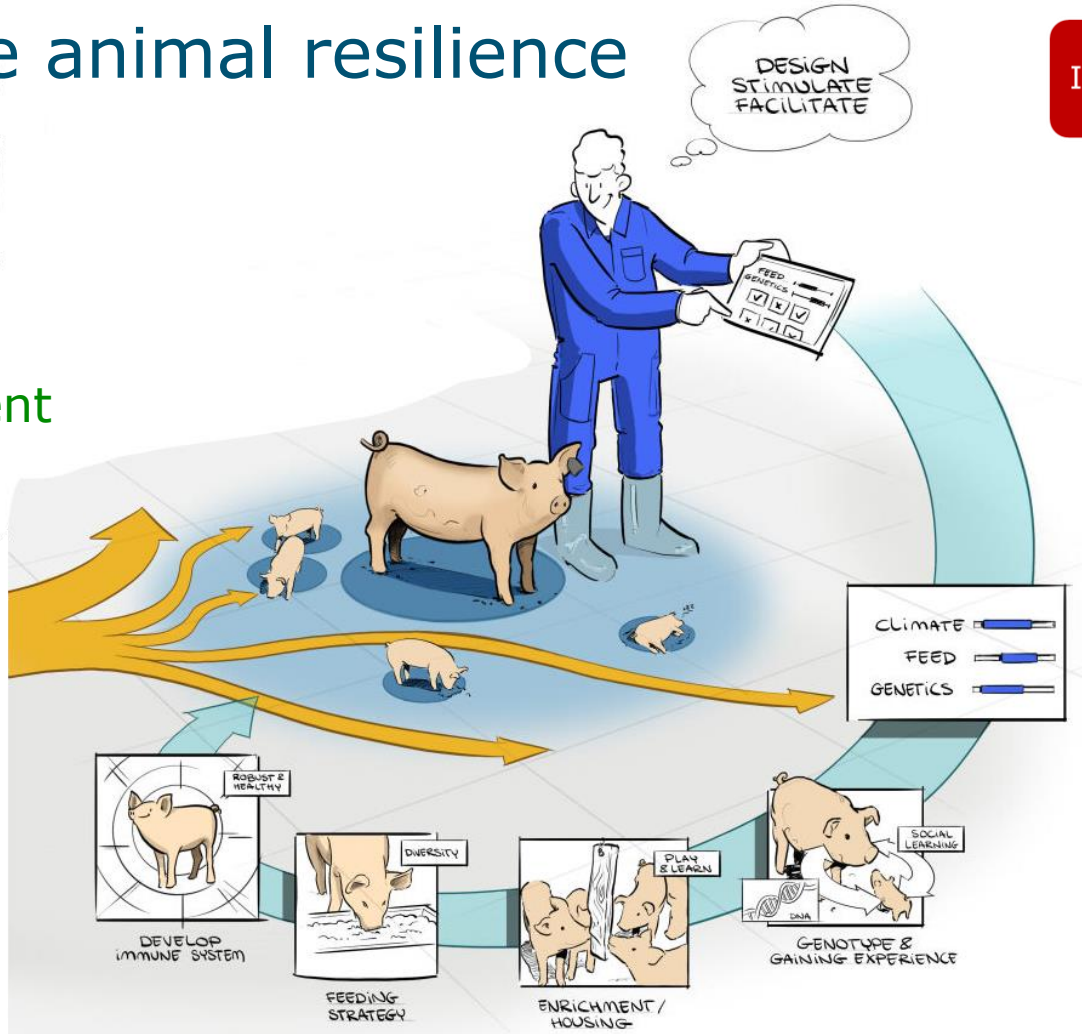
Poppe, M., R. F. Veerkamp, M. L. van Pelt, and H. A. Mulder. 2020. Exploration of variance, autocorrelation, and skewness of deviations from lactation curves as resilience indicators for breeding. Journal of Dairy Science 103(2):1667-1684.

Ways to influence animal resilience

Influence

- Genotype
- Experience
- Housing & Enrichment
- Feeding & strategy
- Immune system
- Microbiome
- Meet specific needs
- **ANIMAL CENTRED**



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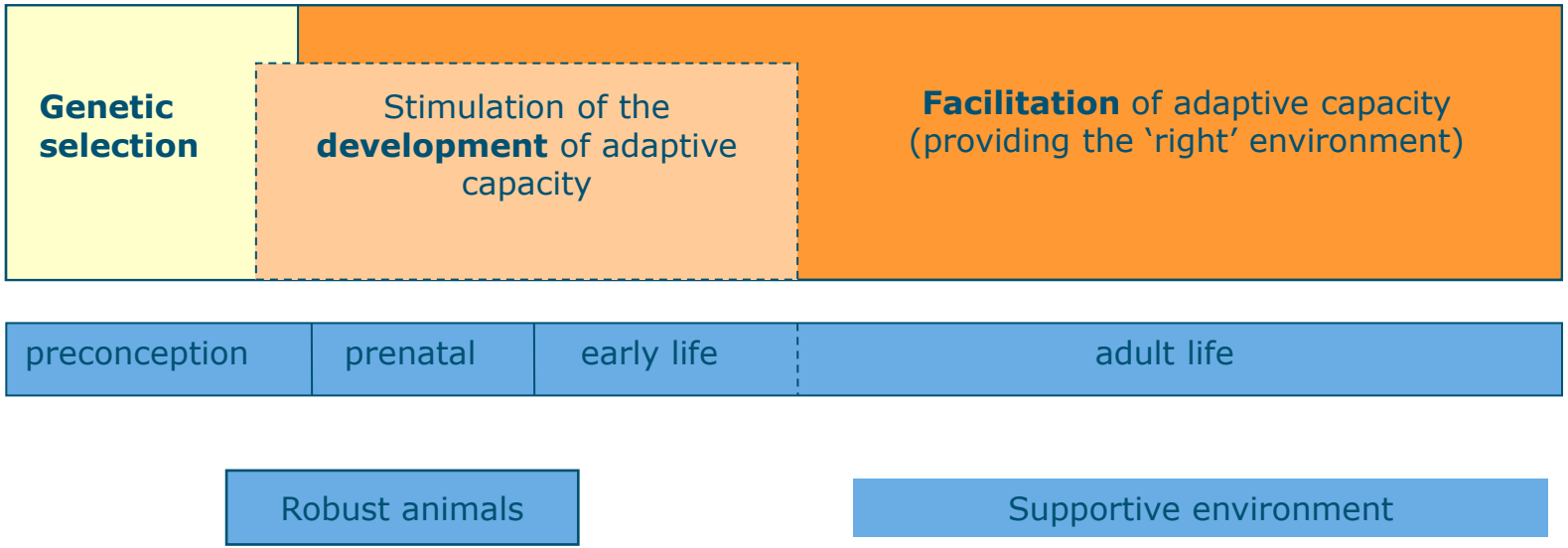
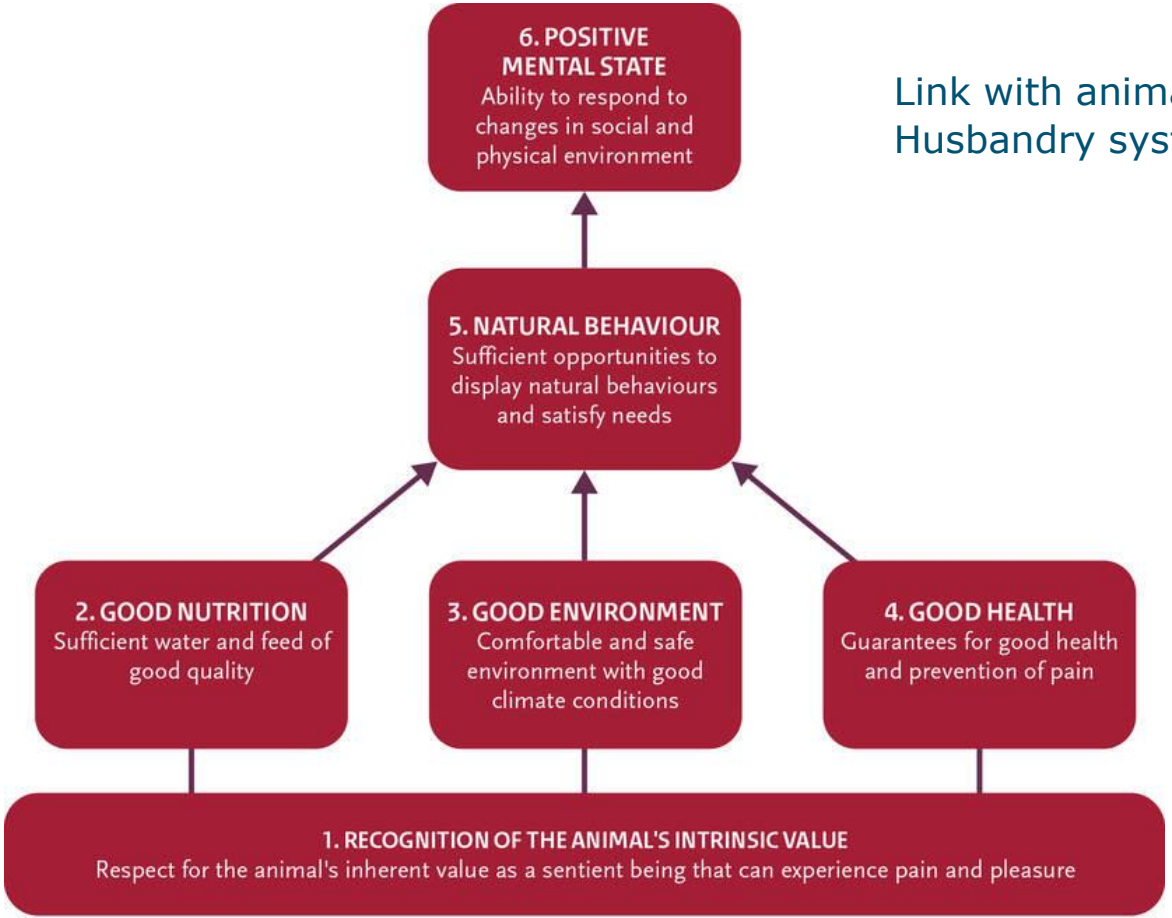
Influencing factors of Resilience

Influence

Overview of different methods (**selection, development, facilitation**) to improve resilience of animals





Link with animal centred Husbandry systems

Beeld: ©RDA
Zes leidende principes voor een dierwaardige veehouderij

Influence

Enrichment enhances disease resilience in pigs

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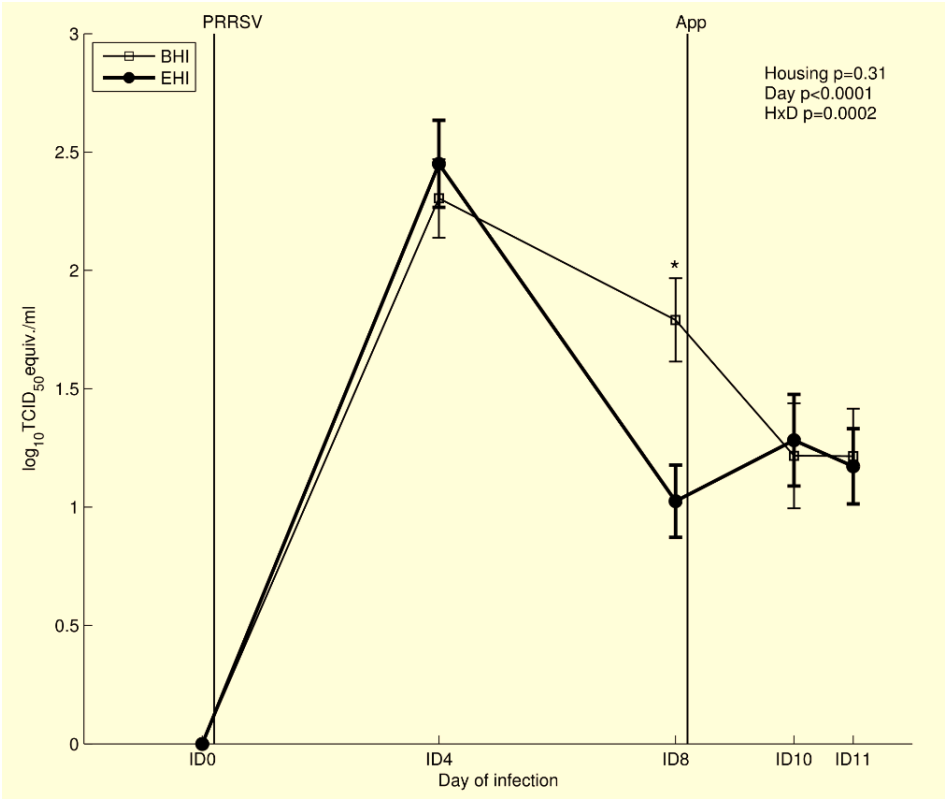
Enriched housing enhances disease resilience



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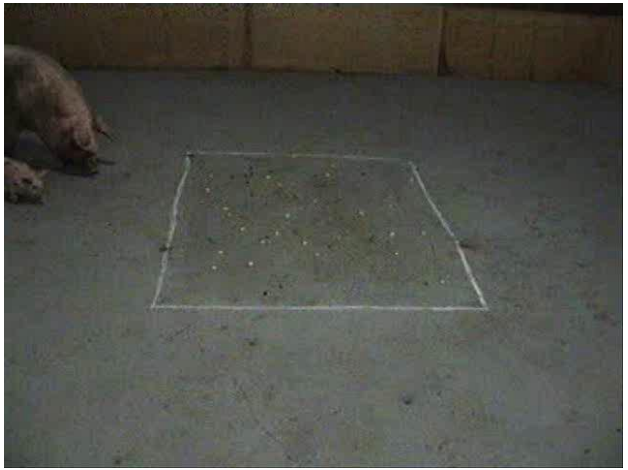
Van Dixhoorn, et al., (2016). Enriched housing reduces disease susceptibility to co-infection with porcine reproductive and respiratory virus (PRRSV) and actinobacillus pleuropneumoniae (A. Pleuropneumoniae) in young pigs. *PLoS One*, *11*(9). https://doi.org/10.1371/journal.pone.0161832

More interactions with the sow

Influence



- In the presence of the sow
  - → Reduced food neophobia
    - faster to touch the food
    - consumed more food items

Loose-housed sow

- → Higher preweaning growth
- → Less damaging behaviours & more play behaviour after weaning

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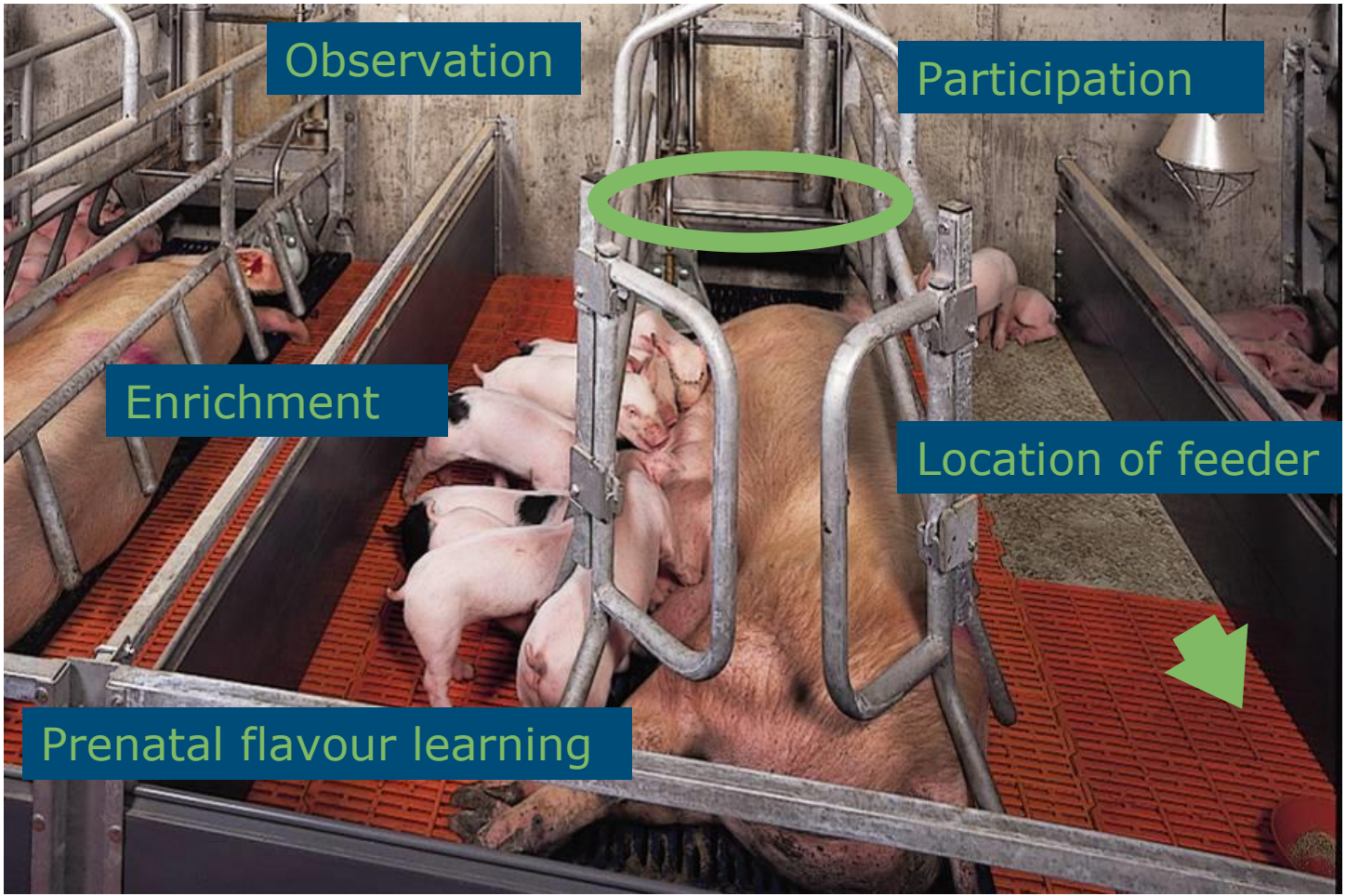
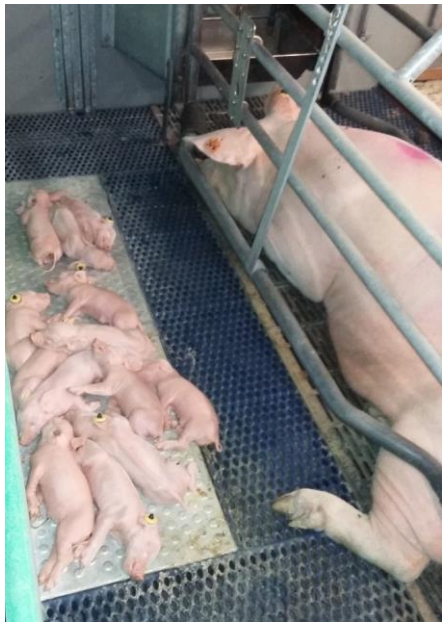
Oostindjer et al, 2010 Biol Lett; 2010 J Anim Sci


Observation
Participation
Enrichment
Location of feeder
Prenatal flavour learning

Strategy Shift

From minimizing perturbations towards

minimizing the consequences of the perturbations



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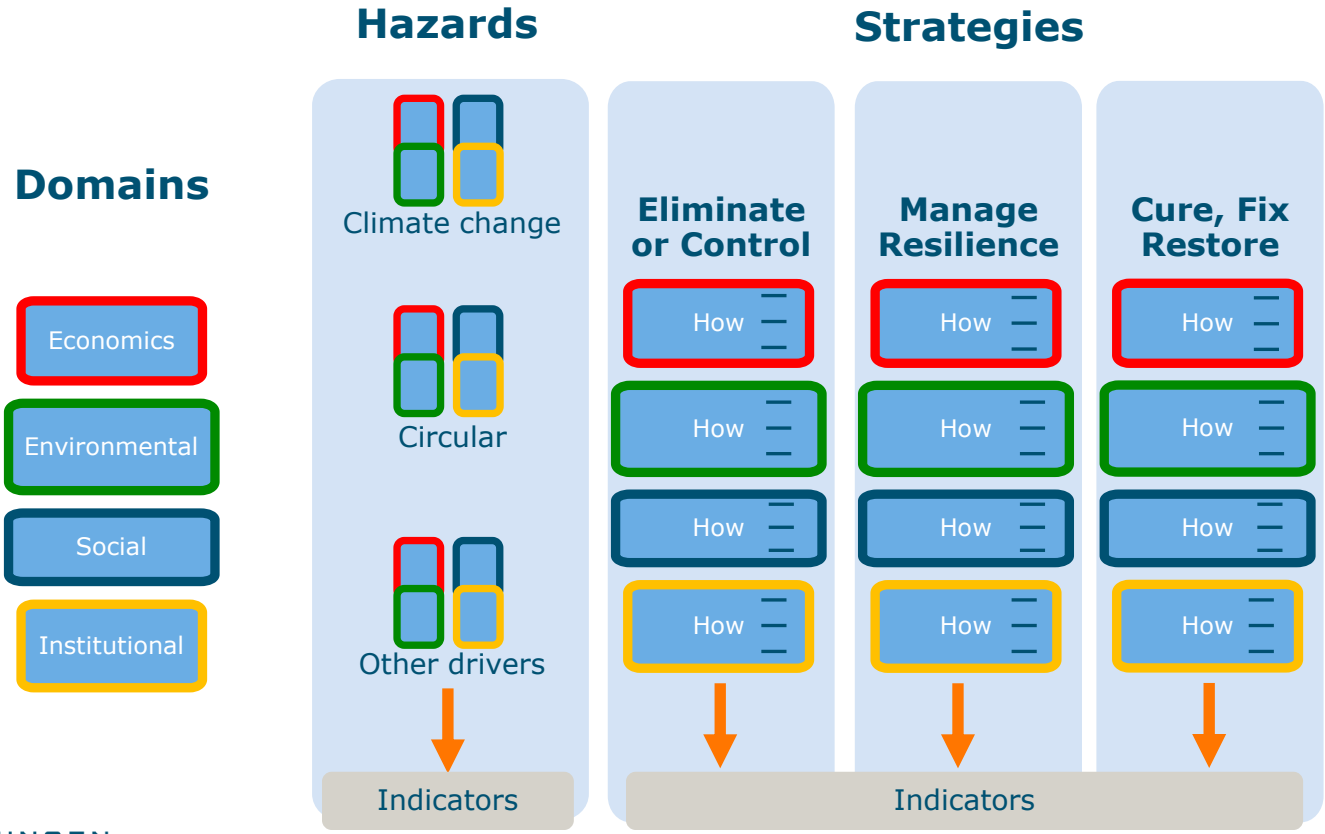
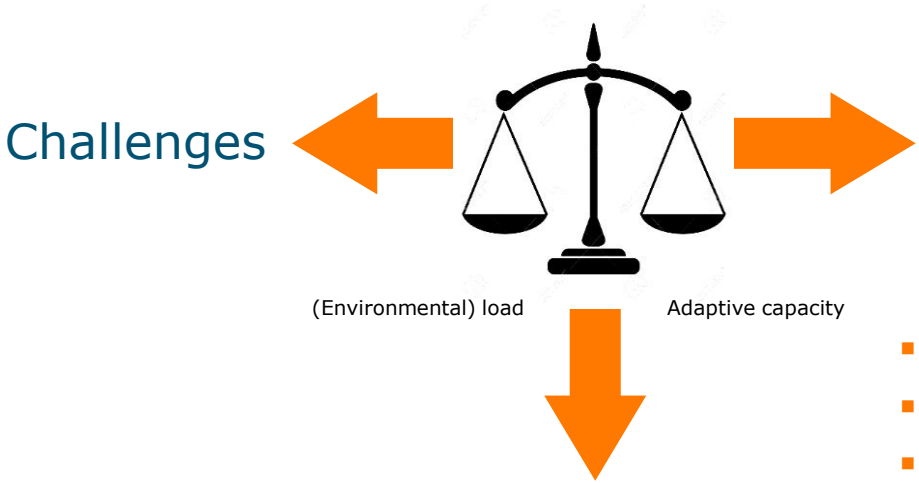
KB project across science groups



Resilience: balance between adaptive capacity and (environmental) load



- Genetic predisposition
- Early life experiences
- Current environment
- Facilitate a positive mental state

Disease

resilience in farm animals

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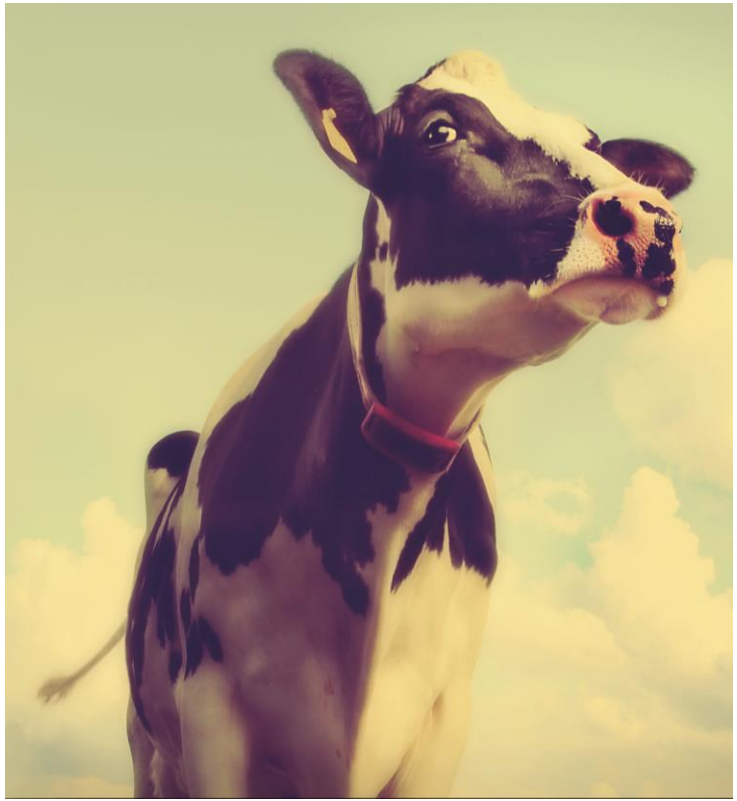
2 Februari 2024

Ingrid van Dixhoorn

Thank you for your attention



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