Temperament traits and stress responsiveness in livestock: a developmental perspective

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Potentially stressful events

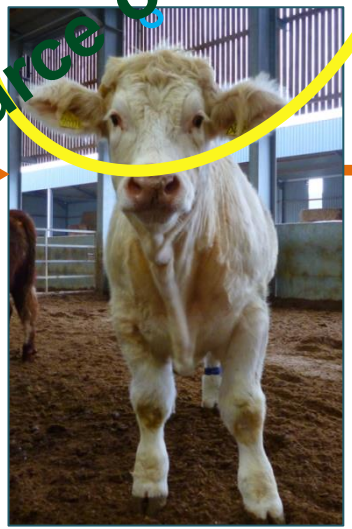
- Potentially stressful events occur routinely in the lives of farm livestock
- Increased stress responses have been shown for:
  - Regrouping with unfamiliar animals
  - Poor handling, veterinary procedures
  - Separation from groupmates
  - Transport
  - Others…

The stress response: 3 elements

the stressor

perception of stressor - innate experience

source of variation



Stress response

Behaviour:

- flight/approach

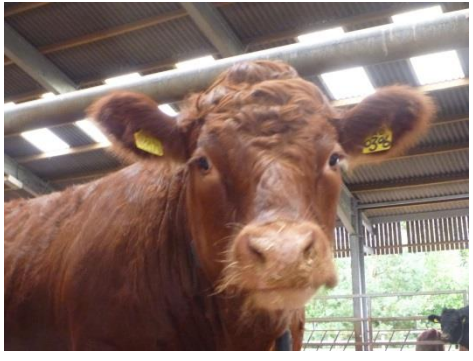
Physiology:

- changes in cortisol
- changes in heart rate

What determines the response?

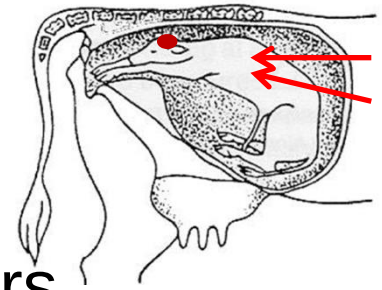
- The level or degree of response depends on:
  - Genetic background
    - Some genotypes or breeds show greater stress response that others
    - QTL's identified for stress responsiveness traits





What determines the response?

- The level or degree of response depends on:
  - Genetic background
  - Prenatal and neonatal experience/stressors
    - During gestation maternal cortisol can cross the placenta and influence fetal development
    - Positive and negative events in neonatal life can also permanently alter biology



What determines the response?

- The level or degree of response depends on:
  - Genetic background
  - Prenatal and neonatal experience/stressors
  - Experience with that situation/stressor over time
    - Learning theory suggests that an innate response to a frightening event will decline with repeated experience if that experience is neutral
    - Repeated negative experience will increase stress response

Timeline of response

So we can think of this as a ‘timeline’:

Embryo with certain genetic attributes → Prenatal/ post-natal influences → Learning/ experience → Response as an adult

This presentation will look at a two examples to illustrate this:

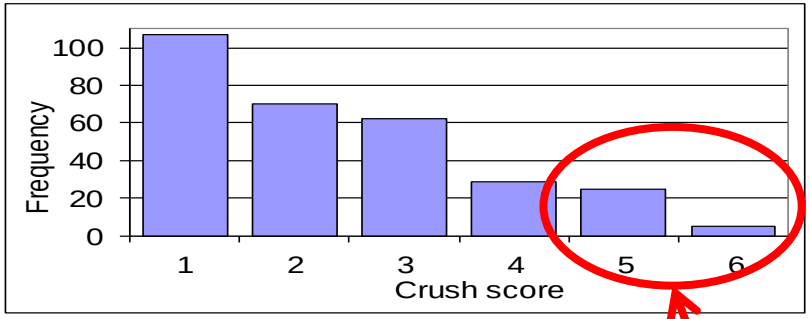
- Handling temperament in cattle
- Aggression at mixing in pigs

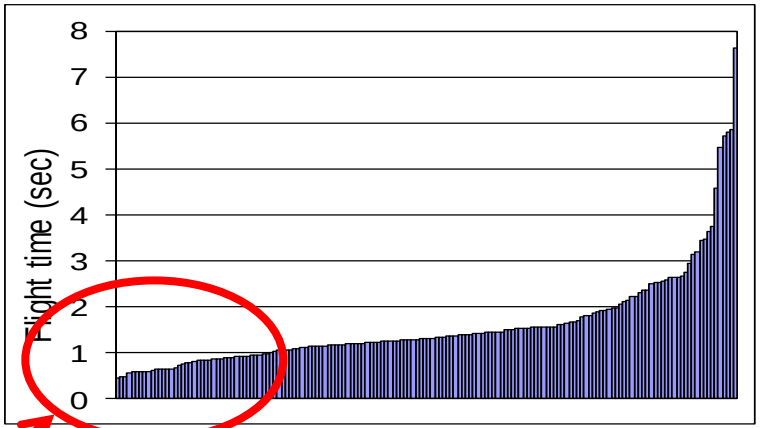
1. Cattle handling

- There is variation in individual response to handling: often known as ‘temperament’
  - Crush score: response to confinement in a crush; scored from calm to agitated
  - Flight time: time to move over a set distance from the crush
  - Docility: measure of ease of handling in a yard
  - Dairy milking temperament: response to milking procedure

Cattle handling

- Individuals are consistent in their response over time and there is variation between animals





Highly stressed

Cattle handling: genetics

Mean heritabilities for different measures:

Crush score: 0.24 (0.03-0.67)
Flight speed: 0.36 (0.05-0.7)
Docility score: 0.26 (0.0-0.61)
Milking temperament: 0.19 (0.07-0.53) Haskell et al., 2014

QTLs detected for handling traits Guitierrez-Gil et al., 2008

GWAS and fine mapping found relationship between temperament and systems regulating sympathetic/parasympathetic nervous system Hulsman Hanna et al., 2014

Genetic influences → **Prenatal/post -natal influences** → **Learning/ experience** → **Response as an adult**

Handling: pre-natal

- No studies relating pre-natal stress to these specific handling measures but:
  - Lay et al (1997) found that transporting pregnant cows altered the physiological response to restraint in their calves. Higher cortisol and higher heart rates

Handling: learning

- Previous experience of gentle handling:
  - Reduces cortisol (Breuer et al., 2003)
  - Reduces heart rate in a veterinary procedure (Waiblinger et al., 2004)

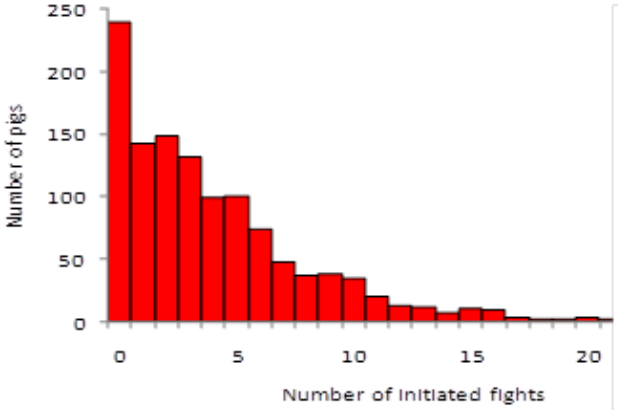
Cattle handling: conclusions

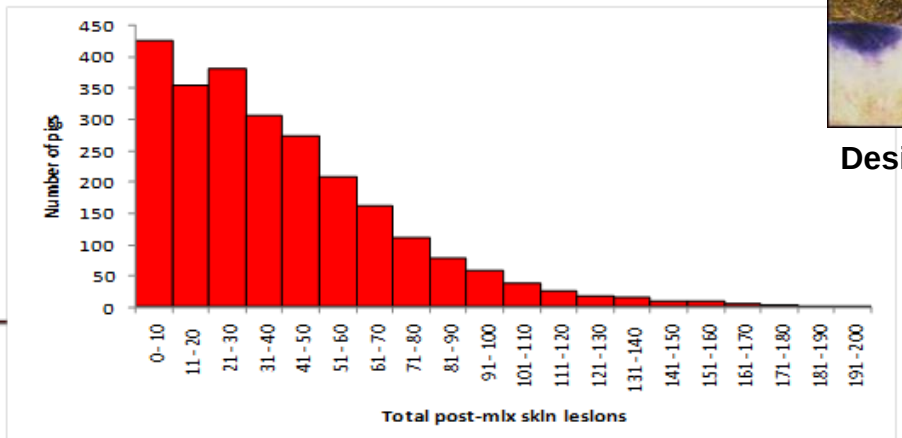
- Genetic influences and experience affect behavioural response to handling
- More research needed for pre-natal effects, but likely that behavioural response will be affect by pre-natal conditions

2. Pig aggression during mixing

- Pigs are routinely mixed into new groups with unfamiliar animals and will fight to determine dominance rank.
- Considerable variation between animals

Desire et al., 2015





Pig aggression: genetics

Reciprocal fighting:
h^2=0.43 (se 0.04)

Delivery of bullying:
h^2=0.31 (se 0.04)

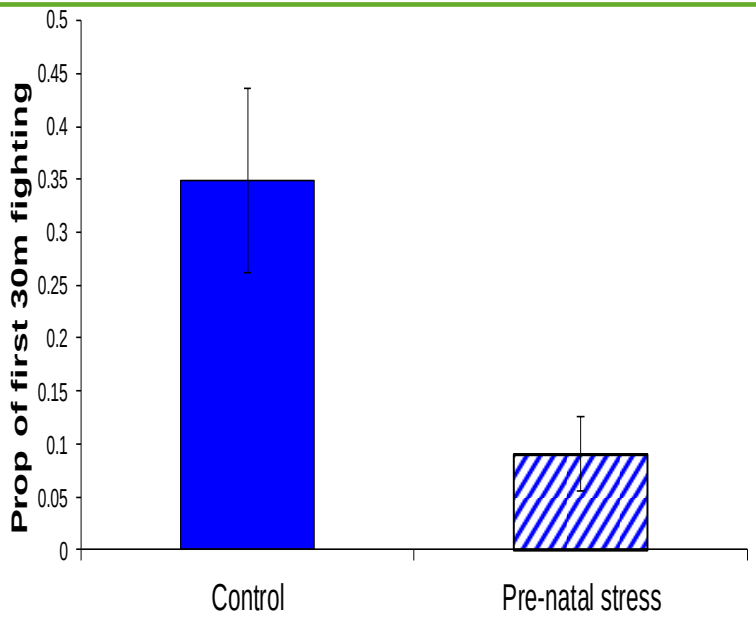
(Turner et al., 2009)

Genetic influences → **Prenatal/post-natal influences** → **Learning/ experience** → **Response as an adult**

Pig aggression

- Pigs **will** fight on mixing
- Two individual strategies are evident from studies:
  - Intense fights directly after mixing; less fighting thereafter
  - Less fighting immediately; fights occur over many days

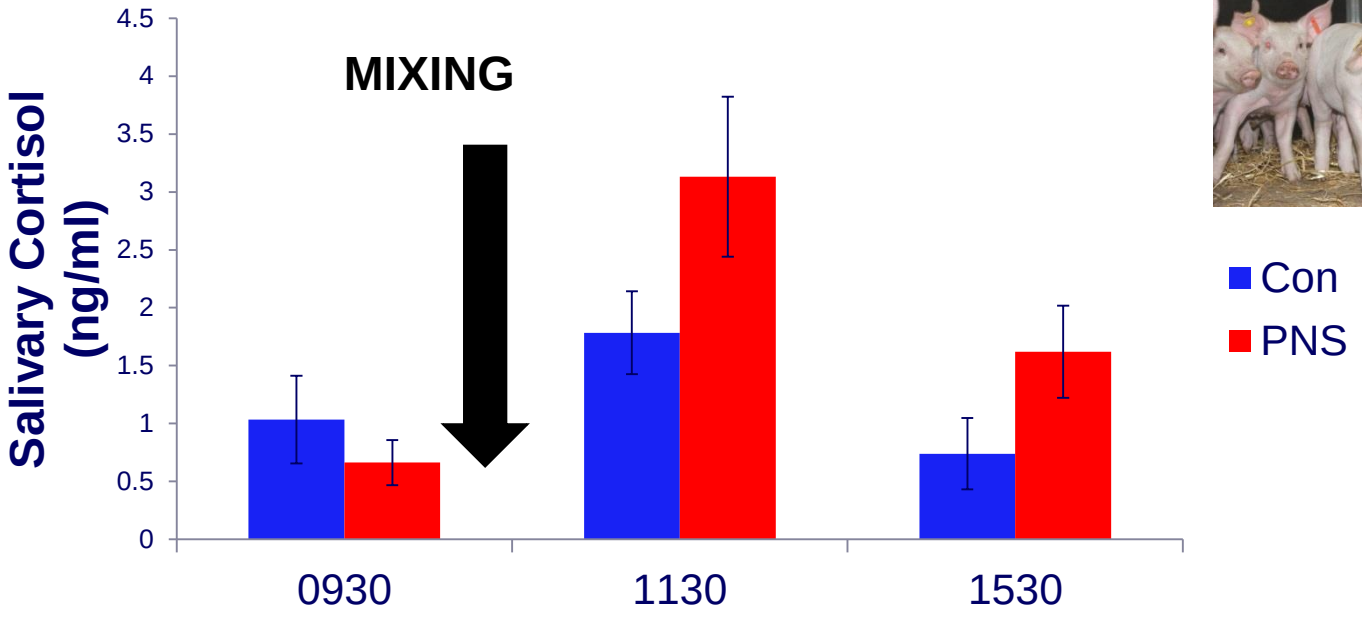
Pig aggression: prenatal stress



Pre-natally stressed (PNS) offspring are **less aggressive** during the first 30mins post-mixing
Other studies have shown **more agonistic interactions** in stable groups after weaning (Jarvis et al 2006)

Genetic influences → **Prenatal/post-natal influences** → **Learning/ experience** → **Response as an adult**

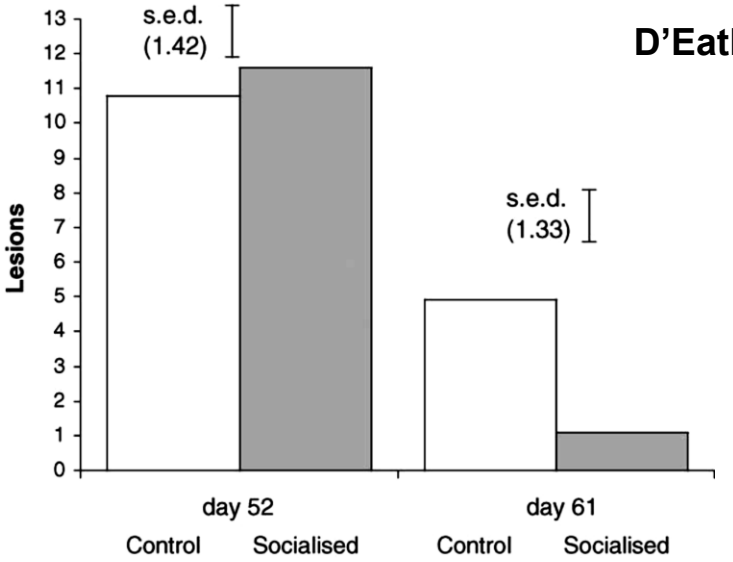
Pig aggression: prenatal stress



Levels of **cortisol** are **increased** in response to mixing into a new social group at ~10wks old (Jarvis et al 2006).

Pig aggression: experience

- Piglets ‘socialised’ days10-30 of life and mixed at day 50
- Socialised piglets started fighting sooner, had more intense fights. Fights completed and formed a stable hierarchy more rapidly. Fewer fights overall



D’Eath, 2005

Genetic influences

Prenatal/post -natal influences

Learning/ experience

Response as an adult

Pig aggression: conclusions

- Genetic effects on aggression
- Fight pattern strategy affected by pre-natal stress
- Modified (ameliorated?) by experience

Overall conclusions

- Selective breeding, prenatal effects and experience all affect the stress responsiveness of the individual
- There are welfare consequences
- Impact on productivity through reduced growth

Overall conclusions

- Good breeding choices: use a breed or strain that shows appropriate behaviour
- ‘Mothers matter’: good care of pregnant livestock (at the individual level) will reduce stress responsiveness of offspring
- Good handling and management: reducing frequency of mixing, good handling will reduce stress response

SRUC

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Aspect Ratio Check
Should look circular