Breeding for both animal welfare and production efficiency

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What is animal welfare?

1. Freedom from hunger or thirst

2. Freedom from discomfort

3. Freedom from pain, injury or disease

4. Freedom to express (most) normal behaviour

5. Freedom from fear and distress

Turner, Conington and Dwyer. 2015. Opinion paper: is there a role for breeding for welfare improvement? Animal 9:8.
Brambell Commission. 1965. A Report of the Technical Committee to enquire into the Welfare of Animals kept under Intensive Livestock Husbandry Systems. Her Majesty's Stationery Office (Cmnd Paper 2836), London, England.

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Consumers want cheap meat – which traits should we improve?

- Efficient production is pigs that:
  - Have high fecundity, good longevity
  - Efficient in converting feed to meat
  - Grow fast and deposit mainly meat

- Traits in a breeding goal can be
  - Total number born
  - Growth rate
  - Lean meat yield

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What happens to welfare?

- Increased focus on animal welfare
- Consumers demand cheap food AND good animal welfare

The pig should be free from discomfort and pain

- Traits in a breeding program can be
  - Osteochondrosis, causing lameness
  - Shoulder ulcer at weaning

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Can we pig breeders do anything to increase welfare?

- Aim: *Estimate genetic correlations between traits related to production efficiency and traits related to welfare*

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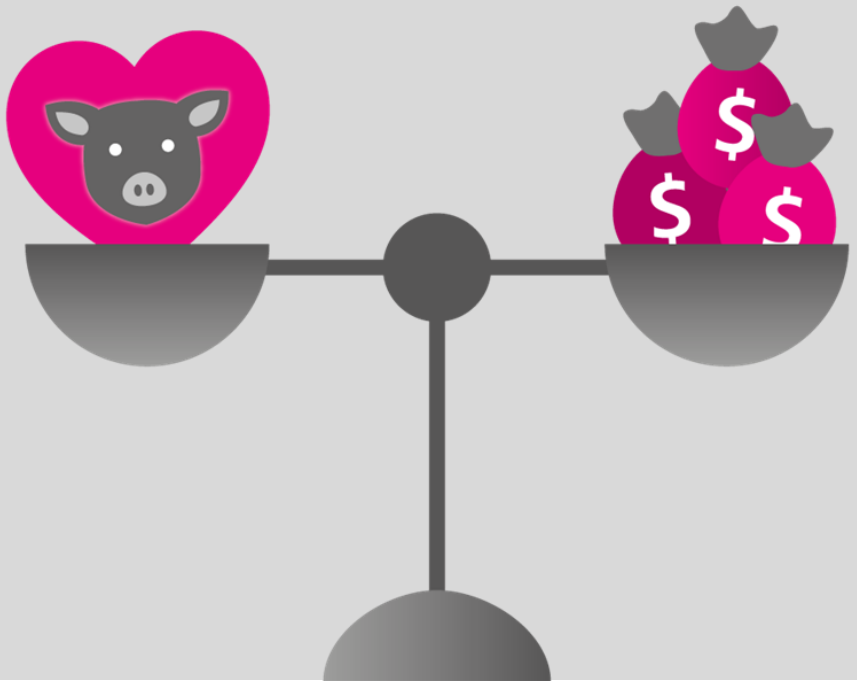
The traits

- Traits representing production efficiency:
  - Total number born (TNB)
  - Growth rate (GR)
  - Lean meat yield (LMY)
- Traits representing welfare
  - Osteochondrosis (OC) , causing lameness
  - Shoulder ulcer at weaning (SUW)



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Phenotypes collected on the Norsvin Landrace gilts/sows

- Growth rate (GR):
  - The weight at 150 days
  - Measured by technicians
  - N=352 521

- Total number of piglets born (TNB):
  - Registered by the farmer at farrowing
  - N=41 221

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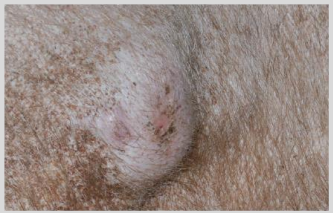
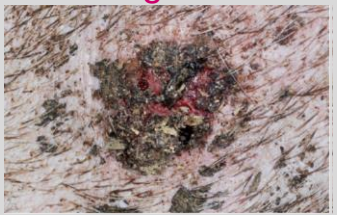
Phenotypes measured on sows: Shoulder ulcer

- Measured on the sow at weaning of first litter (SUW)
  - Measured by the farmer, N=41191
- Measuring scale: 0: Intact skin (no ulceration)

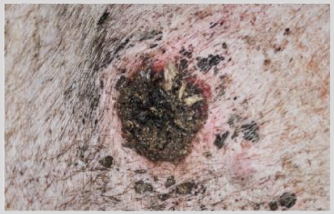
1: Ulcer limited to epidermis



2: Ulcer also involving dermis



3: Ulcer that includes the subcutaneous tissue



4: Ulcer that exposes the bone tissue

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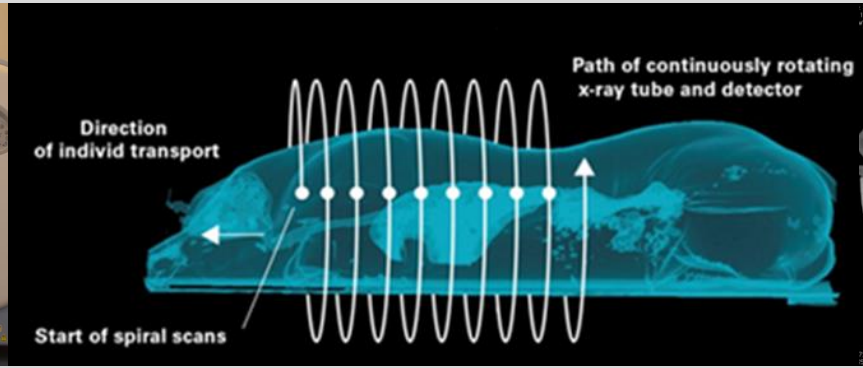
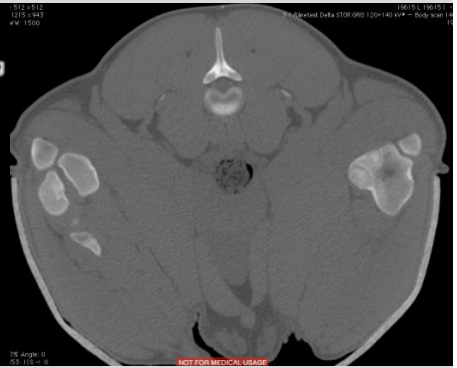
Phenotypes measured on boars: Lean meat yield

- Lean meat yield (LMY)
  - Measured in the boar station test by CT-scanning at 120 kg weight, N=9435
  - Calculated based on X-ray attenuation values
- Resolution:
  - 1.25 mm * 0.93 mm^2
  - ~1200 slices/boar





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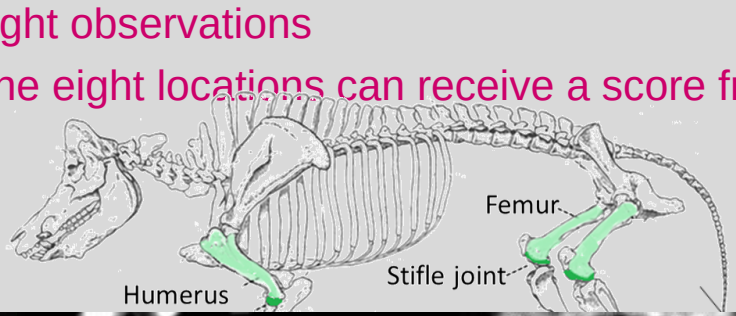
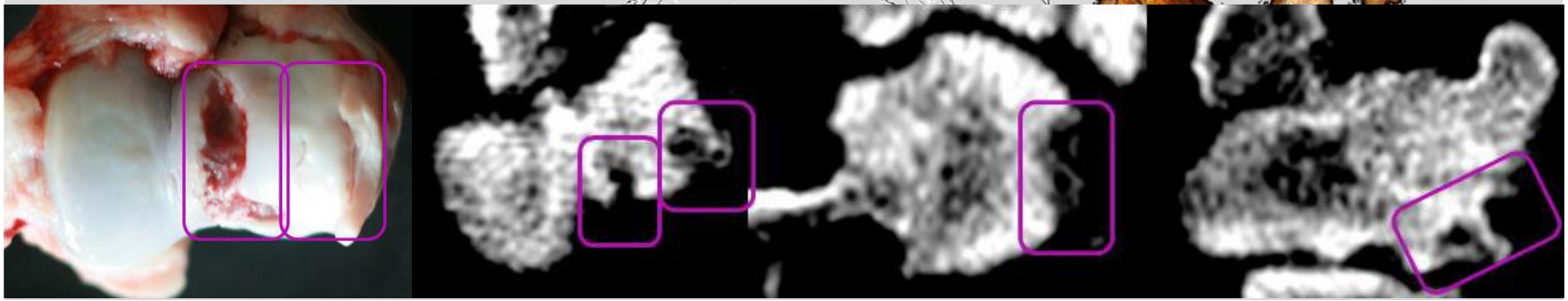
Phenotypes measured on boars: Osteochondrosis

- Osteochondrosis (OC)
  - Measured in the boar station test by CT-scanning at 120 kg weight, N=5448
  - The sum of eight observations
    - Each of the eight locations can receive a score from 0 to 4





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Statistical models

Effect	Type	TNB	SUW	GR	LMY	OC
Parity of Dam	Fixed	x	x	x	x	x
Herd*Year	Fixed	x	x		x	x
Season	Fixed	x	x			
Breed*Year	Fixed	x	x			
Herd*Year*Season_Onfarm test	Fixed			x		
Sex	Fixed			x		
Birth month	Fixed			x	x	
Technician	Fixed			x		x
Room in boar station test	Fixed				x	
Pen in boar station test	Fixed				x	x
Litter born in	Random	x	x	x	x	
ANIMAL	Random	x	x	x	x	x
Age of Dam	Fixed Regression	x				
Age of Dam^2	Fixed Regression	x				
Number weaned	Fixed Regression		x			
Age of litter at weaning	Fixed Regression		x			
Age of litter at weaning	Fixed Regression		x			
Live born in litter	Fixed Regression			x	x	
Live born in litter^2	Fixed Regression			x		
Live weight at CT-scanning	Fixed Regression				x	

TNB: Total number born, first litter
SUW: Shoulder ulcers, first litter
GR: Growht rate, 150 days
LMY: Lean meat yield, 120 kg
OC: Osteochondrose, 120 kg

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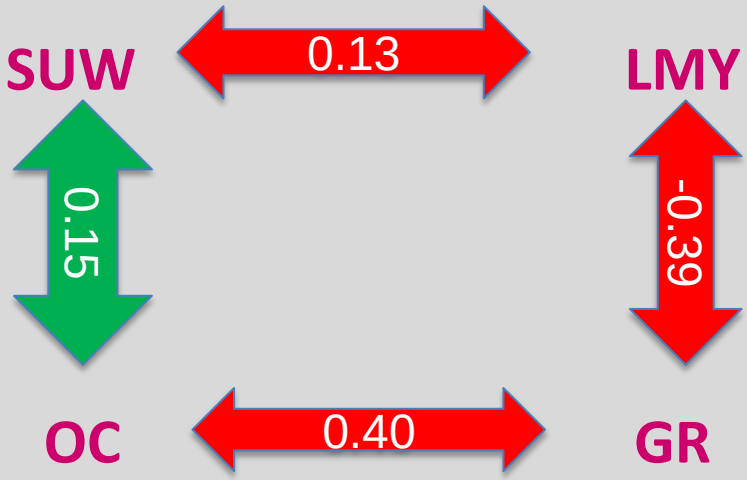
Results

Heritabilities

TNB	0.08
SUW	0.16
GR	0.31
LMY	0.50
OC	0.34

Genetic correlations



TNB: Total number born, first litter
LMY: Lean meat yield, 120 kg
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GR: Growht rate, 150 days

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The role of welfare related traits - conclusions

In this study, some correlations between the chosen welfare- and production traits were unfavourable

To avoid unfavourable development when selecting for lean meat yield and growth rate, shoulder ulcers and osteochondrosis could be included in the breeding goal

These two trait are in the breeding goal of the Norsvin Landrace

Thank you for your attention

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