Components of modern maternal lines

Dr Bjarne Holm

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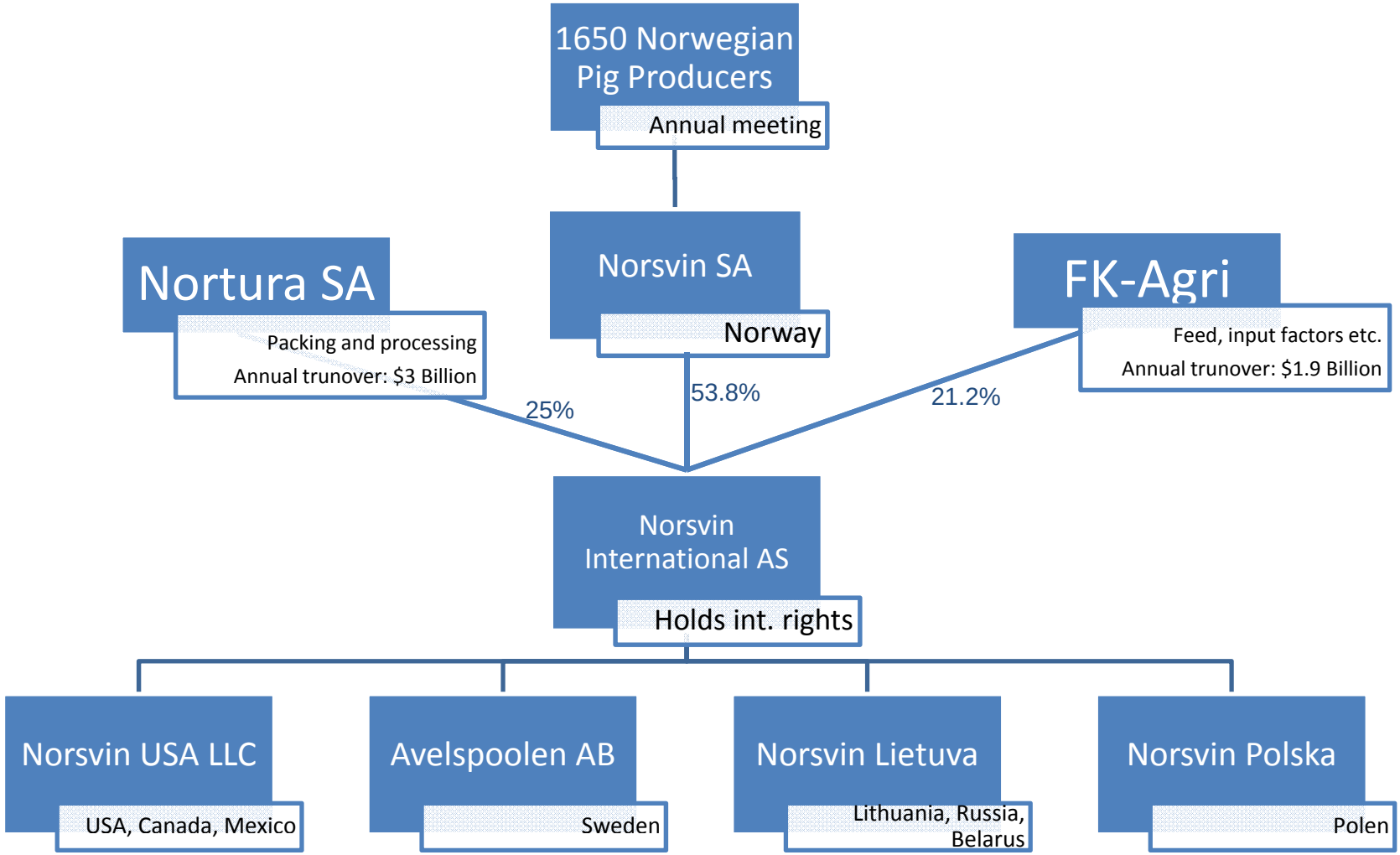
Who am I?

- **Chief Operating Officer**
  Norsvin Group
- **Manager of technology and product development**
  Norsvin USA LLC
  2007 – 2009
- **Head of genetic department,**
  Norsvin International AS.
  2005 – 2007
- **PhD in Genetics in 2004**
- **Born and raised on a pig farm**

Norsvin Group



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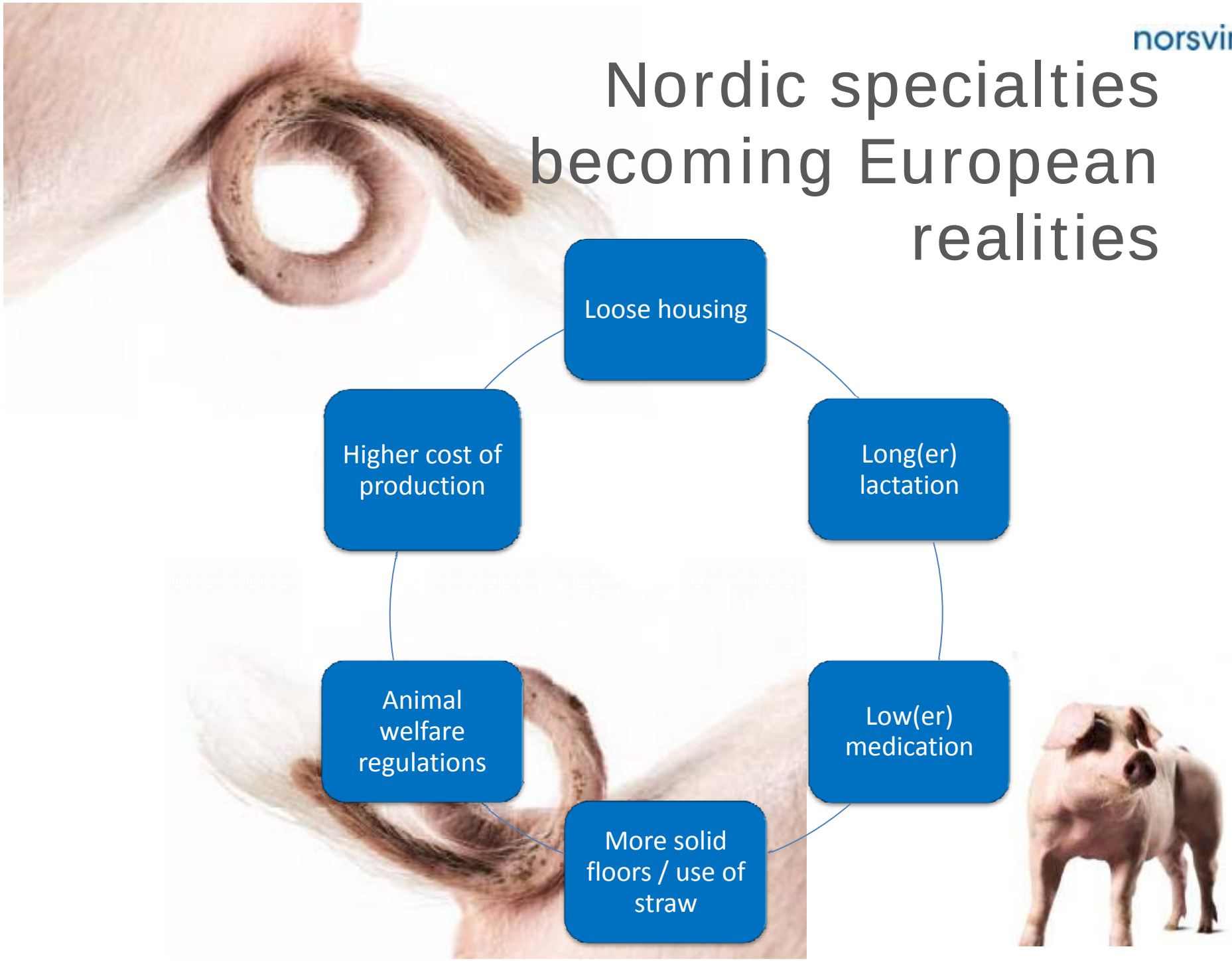
Nordic specialties becoming European realities



LU1

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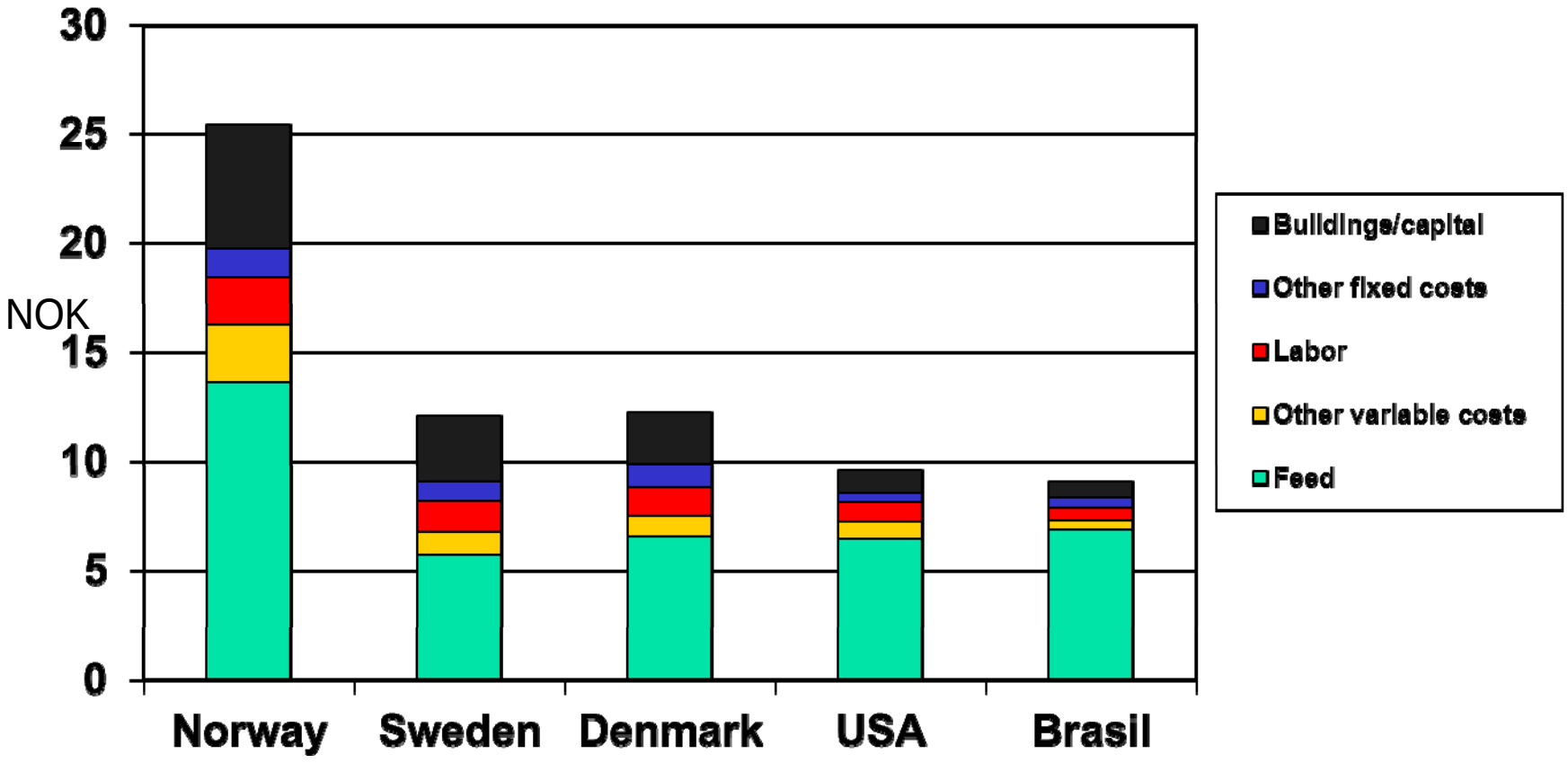
Costs per kg produced pork



Source: Interpig 2009 and Ingris 2009/Norsvins DB 2009
NOK1 = €0,13

Folie 5

LU1 LENOVO USER; 02.12.2011

Long term, price of energy only going up

Price in Norway right;
1 liter = €1.8

Feed cost in Norway; 1.62 € per/kg produced pork meat

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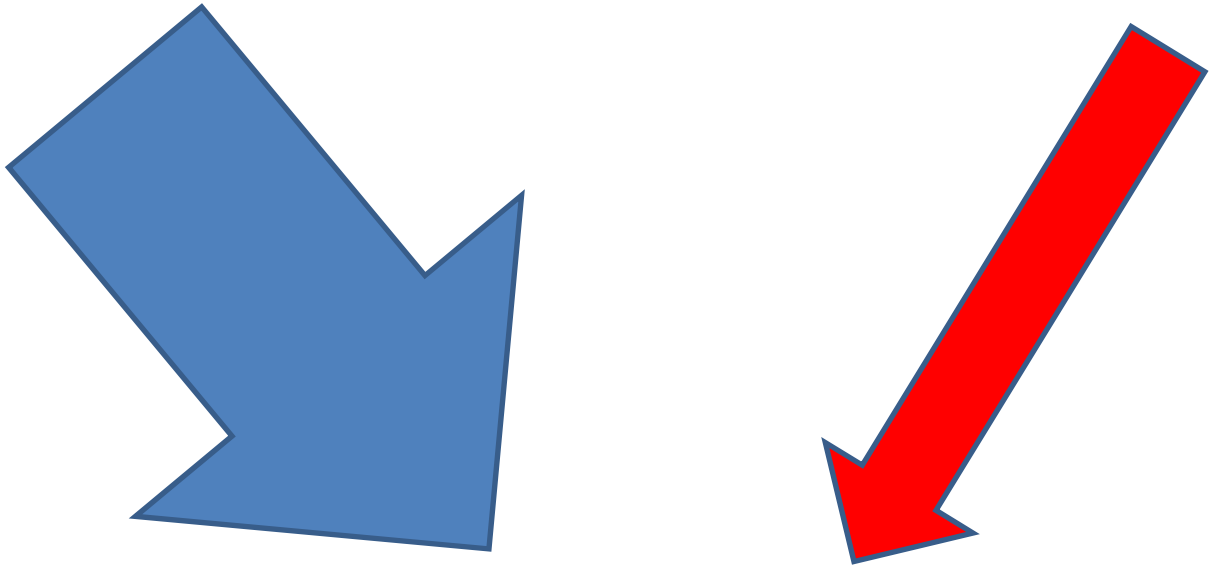
Traditional US/European Swine Industry Parental Contribution to Enhanced Finishing Floor Performance

Terminal Boar Contribution

Dam Contribution



Market Pigs

FABRE • TP

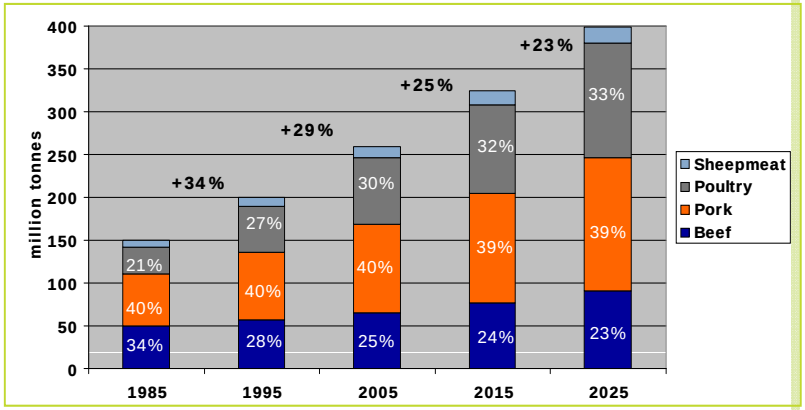
STRATEGIC RESEARCH AGENDA

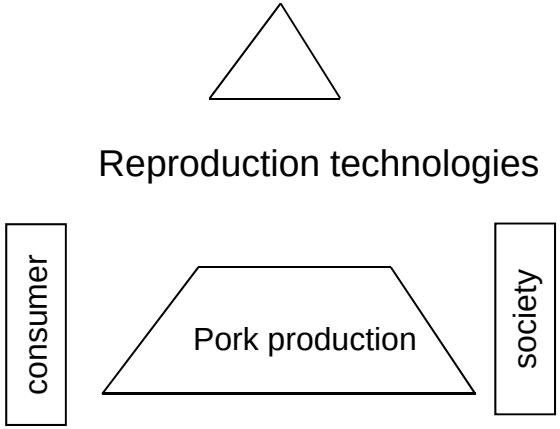
PIGS

Miguel A.Higuera
Bjarne Holm
Jean-Pierre Bidanel
Fenna Zijlmaker
Knol, Egbert

INTRODUCTION

- 40% of meat is pork
- Consumption will increase
- Competition with food and fuel
- Further reduction of costprice





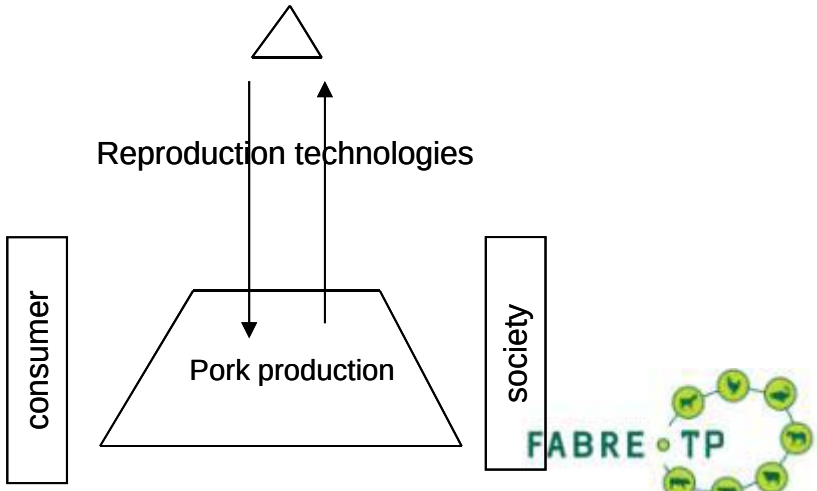
- Health: consumer
- Health: society
- Animal welfare
- Climate change

CHALLENGES, KNOWLEDGE GAPS AND OPPORTUNITIES

- Changing production environment:
  - Feeding
  - Housing
  - Health
- Imperfect understanding of:
  - Feed digestion
  - Genotype-environment interaction
  - Human and animal health

Opportunities

- GENOMICS
- Small flexible high health nucleus populations
- Further improvement of (feed) efficiency



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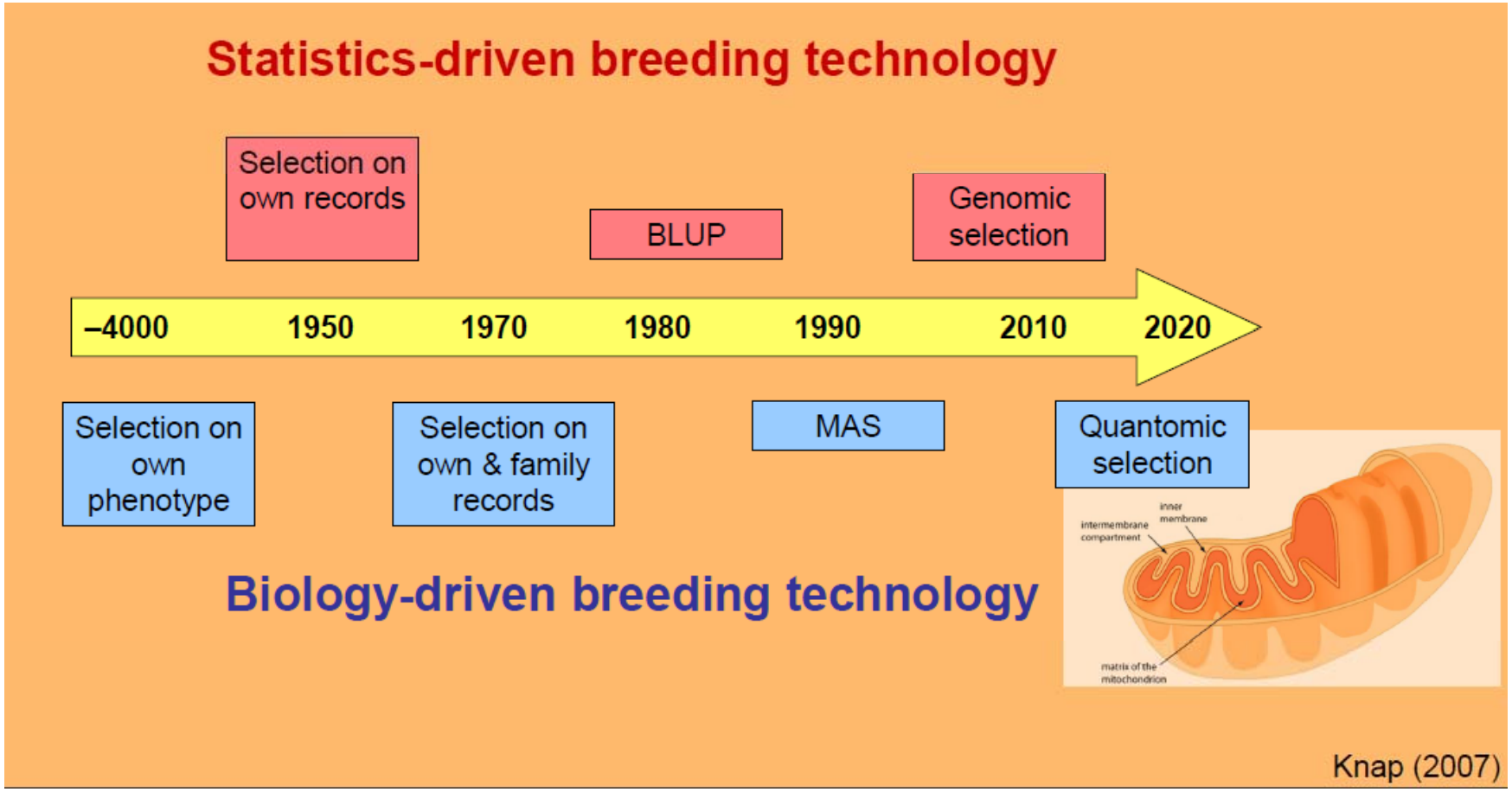
Knap, PIC

International Conference on Feed Efficiency November 9, 2011



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Knap, PIC

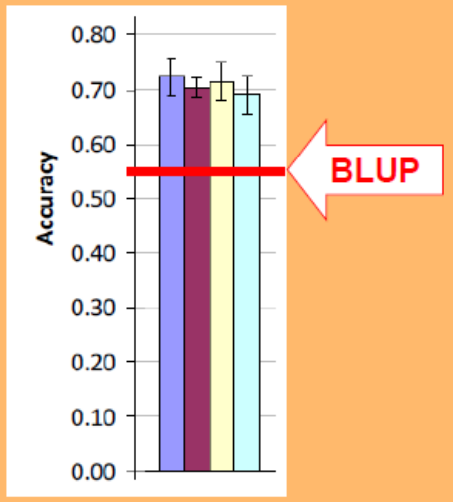
International Conference on Feed Efficiency November 9, 2011

Hypor A Hendrix Genetics Company

PIC

Genomic selection: the first implementation cases in pigs

FCR

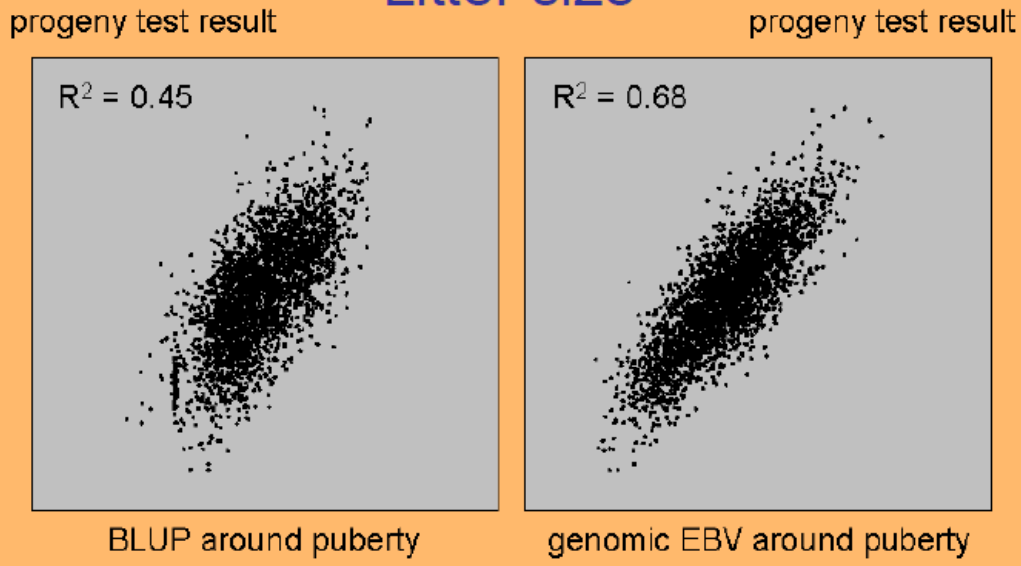


27 % higher reliability →

27 % faster genetic improvement

Huisman (2011)

Litter size



50 % higher reliability →

50 % faster genetic improvement

Deeb (2010), Knap (2011)

PROBLEM OF STASIS

- Europe: many countries
- Breeding programs within countries
- Worldwide trade of meat
- Mainly SME's
- Cost and knowledge intense across species gen- and other -omics developments

- Need for European precompetitive cooperation
  - Between countries
  - Between disciplines
  - Between species
  - Between "humans and species"

RESEARCH PRIORITIES – SHORT TERM

Breeding goal

- Define future production environment
- Including welfare indicators
- Including environment sensitivity (where will production go to)

Technology

- Implementation of genomic technologies!!

Traits

- **Cooperation between feeding and genetics in terms of by-products and gut health**
- **Mothering ability, better sows, longer living which prepare piglets for optimum finishing phase**

RESEARCH PRIORITIES – LONG TERM

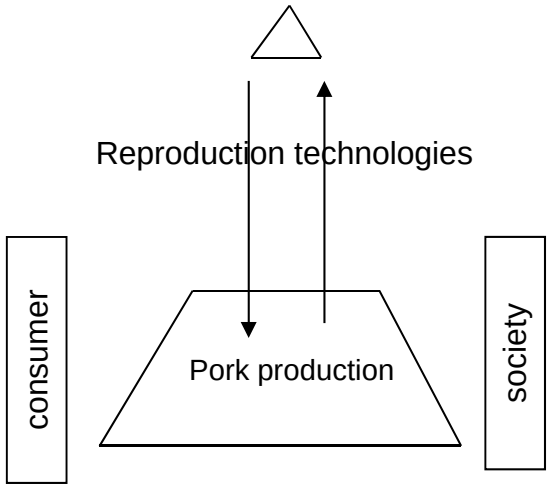
Exploiting gene – environment interaction

Identification of complex regulatory networks and epi-genomic mechanisms at the whole-genome level;

- Need for fully annotated pig genome
- Need for accessible individual genetic identity card

- Offers optimum individual treatment in feeding and animal health
- **Offers 'PUP', predictable uniform pork**

Conclusion I



Genetic selection can strongly help to maintain and strengthen a sustainable pork production.

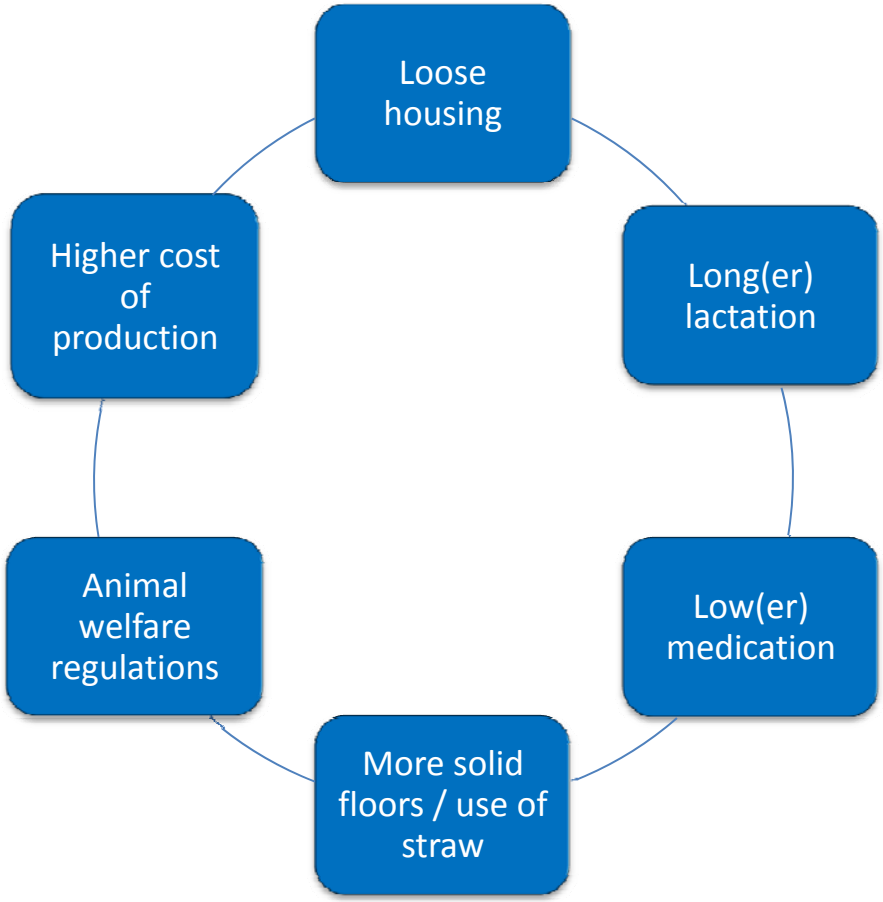
Europe has a head start in open communication with consumers and society,

Components of modern maternal lines

Combine the need for improved pork production efficiency

With

Sustainable, consumer and society approved, production



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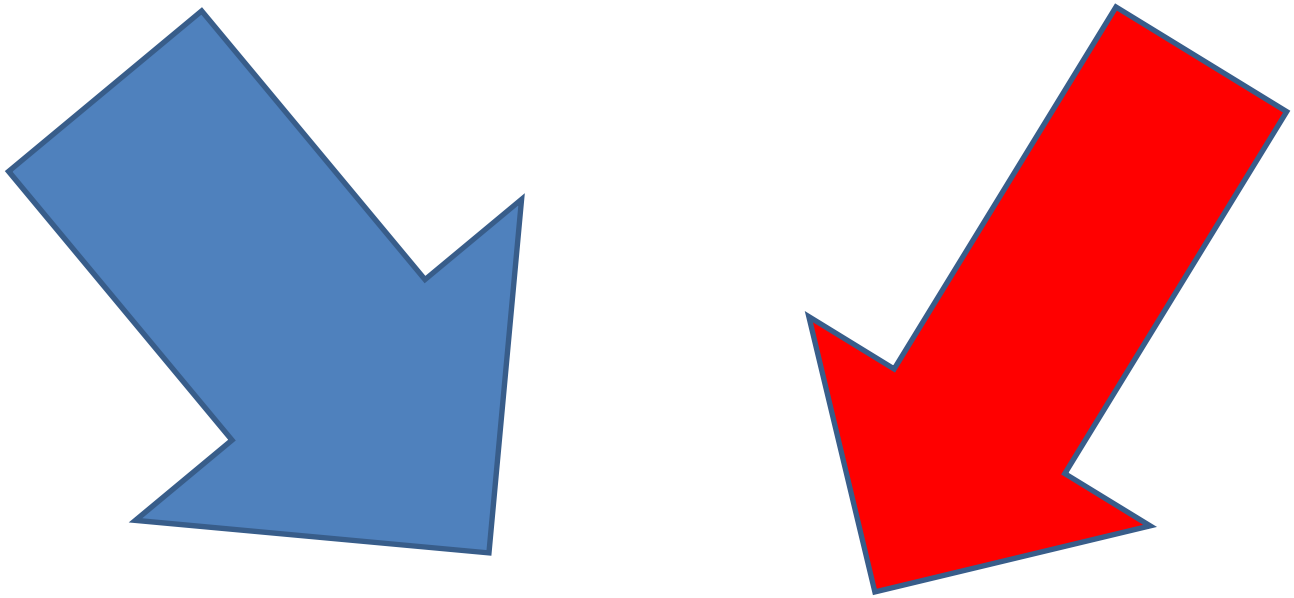
Future Parental Contribution to Enhanced Finishing Floor Performance

Terminal Boar Contribution

Dam Contribution



Market Pigs

50% genetic makeup from terminal sire

50% genetic makeup from dam

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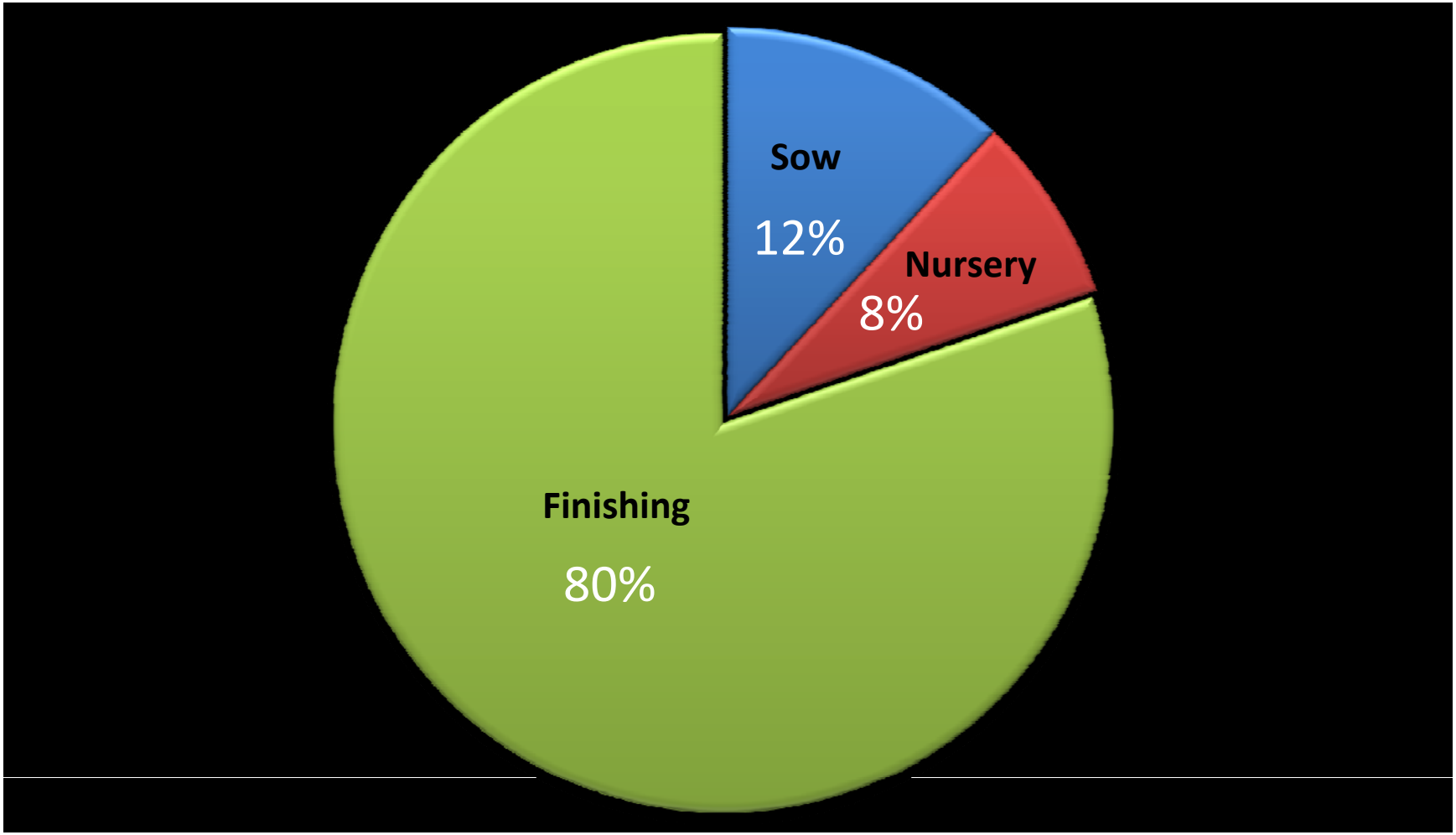
Percentage of Feed per Pig Produced by Stage of Production



chad@v-ast.com

Norsvin® LY – F1

Loose housing

Gestation

- Structure
- Temperament

Loose housing

Farrowing

- Structure
- Temperament
- Maternal behavior

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High demand on capacity through maternal lines / maternal bi-products

- Sow productivity demand in loose housing:

  30+ PSY

  70% of entered gilts wean a 3rd litter

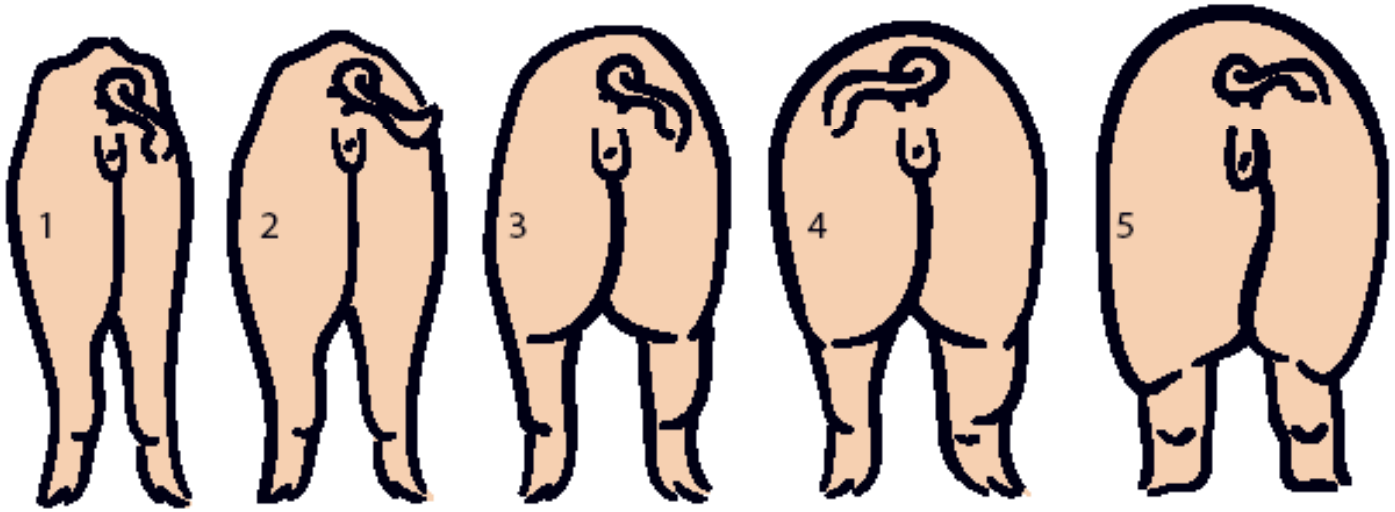
- Capacity maternal bi-products to 130kg live weight with “no” antibiotics:

  ~1000g/day

  60-61 %-lean

  2,2 FE

Condition Score



Score	1	2	3	4	5
	Emaciated	Thin/Poor	Good	Overweight	Over fat
Pin bones and tail	Very prominent pin bones and deep cavity around the tail setting	Pins bones covered but only slightly. Tail setting covered.	Pin bones covered, only felt with firm pressure. No cavity around tail.	Cannot feel pinbones. Root of tail set deep in surrounding fat.	Further deposition of fat is impossible.
Loin	Very narrow. Flank hollow. sharp edges on transverse spinal process.	Narrow, flank still rather hollow. Edge of transverse spinal process has some covered.	Flank full. Edge of transverse spinal process covered.	Flank full and rounded. Cannot feel bones.	Further deposition of fat is impossible. Body rotund.
Backbone	Vertebra prominent and sharp.	Prominent vertebrae.	Vertebrae just palpable with pressure.	Cannot find vertebrae.	Midline appears between rolls of fat.
Ribs	Individual ribs visible and prominent.	Ribs are still reasonable apparent and can be felt but there is cover.	Rib cage not visible and it is difficult to feel the ribs.	Cannot feel ribs.	Thick fat cover.

Hands – on Condition Scoring

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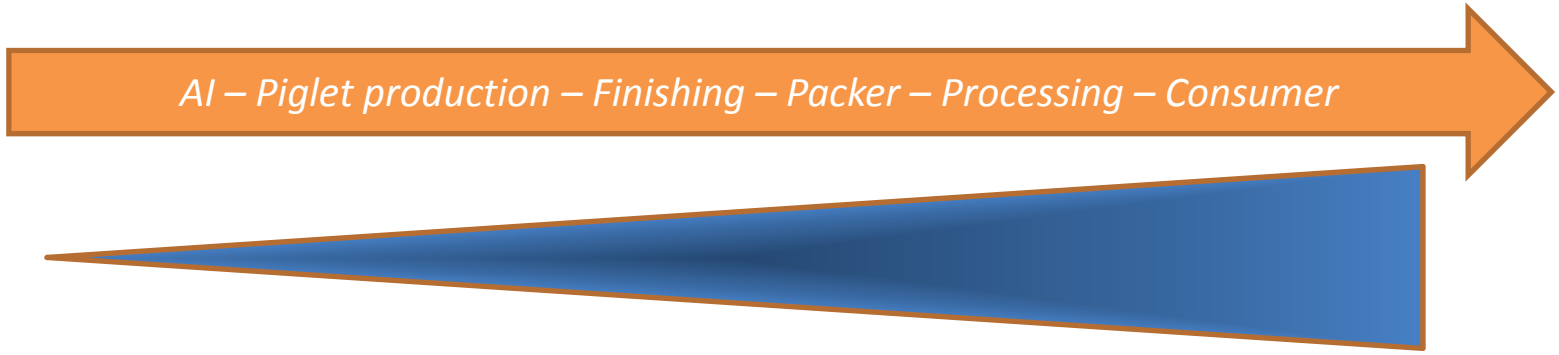
R&D costs are rising to meet future demands on performance

Focus even more on research and development that brings efficiency through the female

Norsvin Genetic Strategy

Create competitive advantage for an integrated industry



Norsvin genetic strategy

- Combination high density phenotyping & genomic selection
- Keep focus on the integrated economic model
  - Including “all” aspects of chain of value in pork production
  - Wide and sustainable breeding goal
- Increased throughput through reduced mortality and morbidity
  - More emphasis on piglet quality
  - Proper use of piglet weights combined with other breeding goal traits
  - Direct as well as indirect selection for sow longevity
  - Possibilities for disease tolerance
- More accurate tools demands more surveillance of possible unfavorable side effects & close cooperation with customers
- Seek partnership to strengthen R&D and product quality

Norsvin is not a low cost strategy genetic supplier

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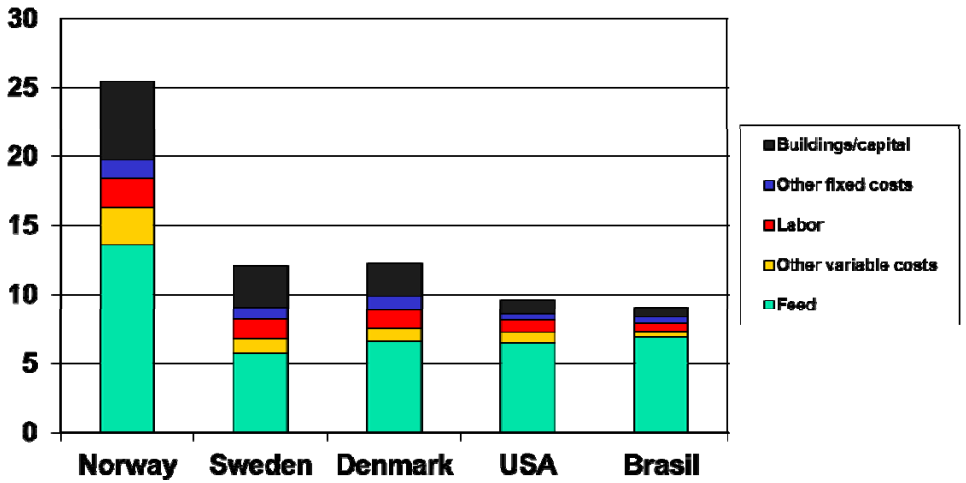
Cost is a great motivator



Norsvin's mission and main task has for decades been to:

- **Build a genetic system that brings efficiency, productivity and quality to the market hog and the pork from both the maternal and the terminal**
- Simultaneously, develop a prolific but balanced female
  - *Ave weaning age is 32 days*

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Norsvin, the short story

- Extremely expensive production circumstances in Norway, therefore the focus has been on feed efficiency, productivity and prolificacy for more than 50 years
- Norsvin is producer owned – cooperative
- The same farmers also own the main packer and the feed provider

→ Broad breeding goals, including 'all' aspects of the industry; focus on fully-integrated system

  – AIM: Sustainable, long term genetic progress

Updated maternal breeding goals 2010:
From quantity to quality

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Efficiency
Feed & Growth

Reproduction and maternal ability
Total born
Litter weight
Individual piglet weight at 3 weeks
Still born
Preweaning mortality

Meat quality
IMF
pHu
Drip loss

Exterior / robustness
Functional teats
Functionality
Sholder sore
Body condition at weaning

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Complex reality

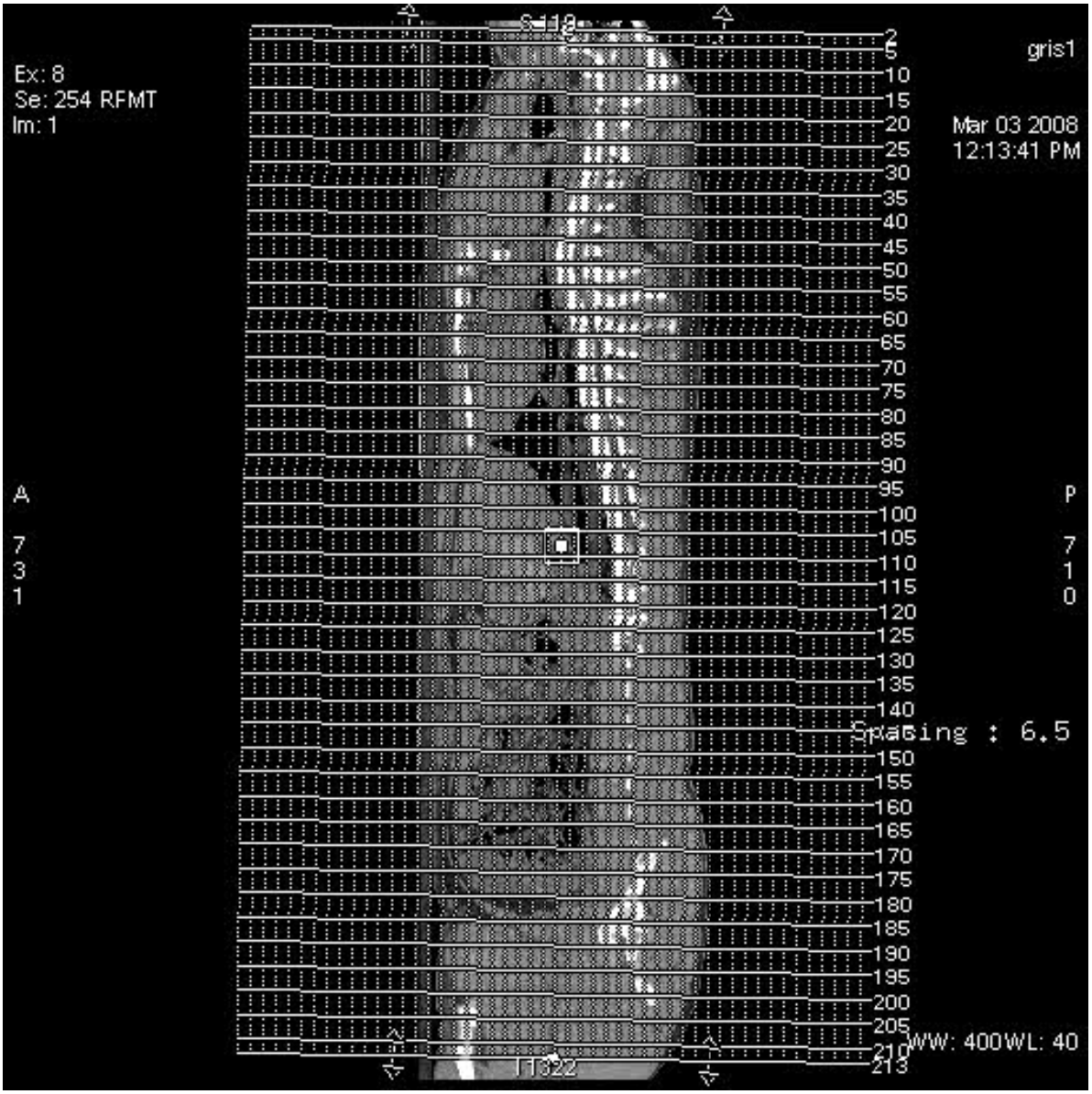
Norsvin Landrace (currently; repeatability model, ~50% P1 litters)

Landrace	TB	SB	PM	LW, d21	SS	BCW
TB	**0,11**	0,34	0,59	0,42	0,07	-0,15
SB		**0,07**	0,17	-0,06	0,12	-0,18
PM			**0,07**	-0,25	-0,14	0,11
LW, d21				**0,09**	0,11	-0,30
SS					**0,22**	-0,68
BCW						**0,18**

TRAITS	***# RECORDS***
TB: total born	*156 000*
SB: still born	*156 000*
PM: piglet mortality	*65 000*
LW: d21: litter weight at day 21	*110 000*
SS: shoulder ulcers	*27 000*
BCW: body condtion at weaning	*23 000*

Norsvin maternal and terminal boar test

- 3,500 purebred boars on-test annually
- Test period: 35 to 120 kg
- During test:
  - Individual feed efficiency
  - Individual gain/growth curves
- Off test:
  - CT-scanning
  - Manuel and video evaluation of exterior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gris1
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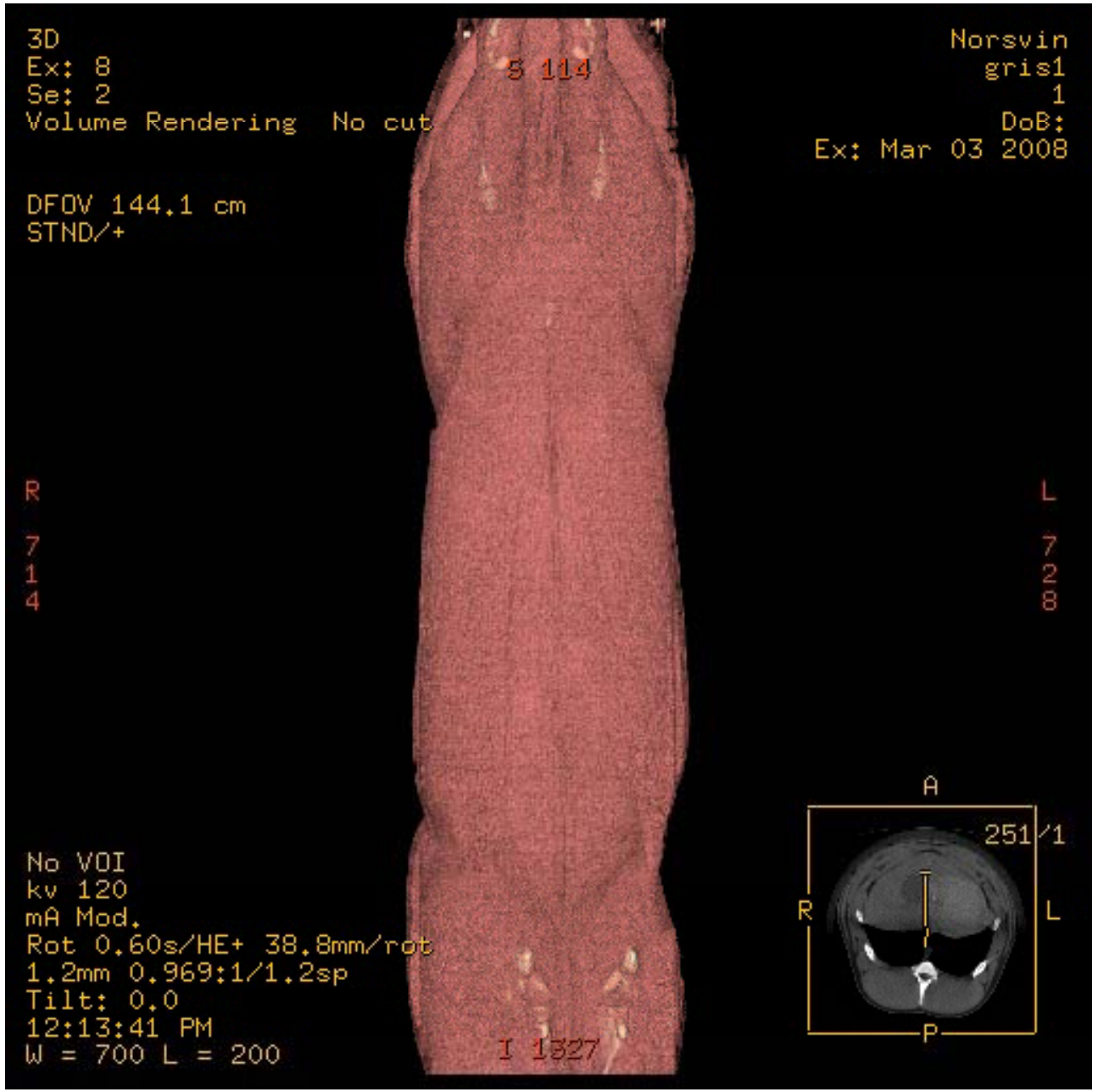
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1.2mm 0.969:1/1.2sp
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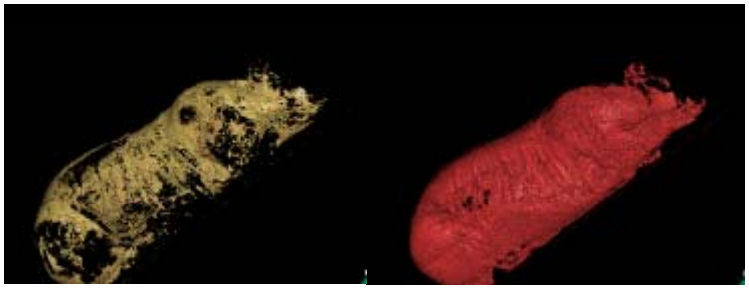
Hard but balanced selection

Efficiency and growth

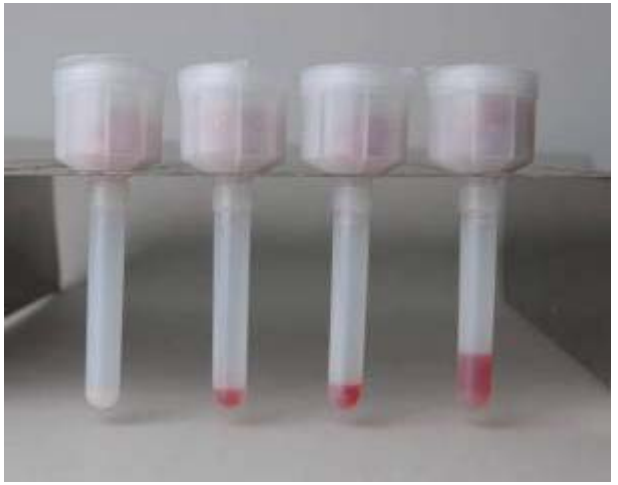
+

Carcass, structure, etc



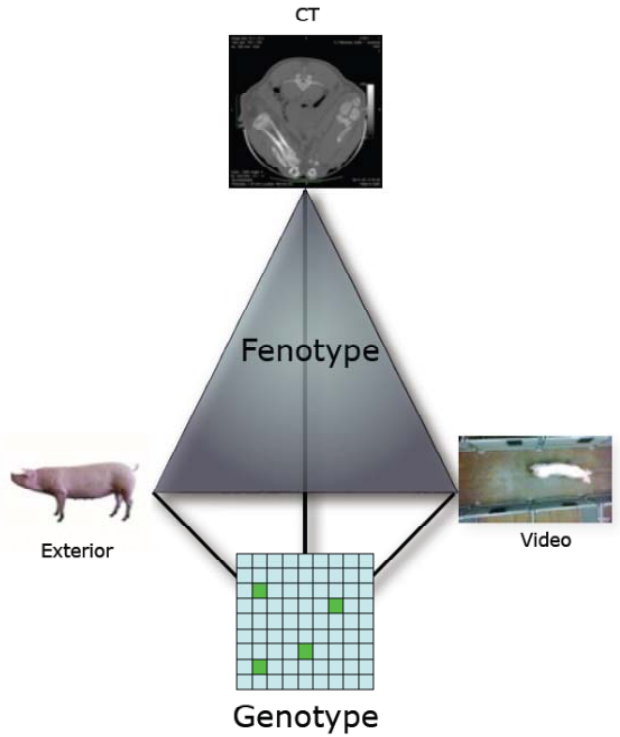
+

Meat- and fat quality



Robust pigs by improved exterior functionality and reduced osteochondrosis using non-invasive technology

- Project leader Dr. Grindflek, Norsvin
- The project involves 1 senior scientist, 2 post.doc, 1 PhD-student, 50 % technicians, 75% scientific assistent, 2 PhD- advisors
- Ramme: 16 mill NOK/4 years
  - NVH
  - UMB
  - Norsvin
- Partly financed by Norwegian research council



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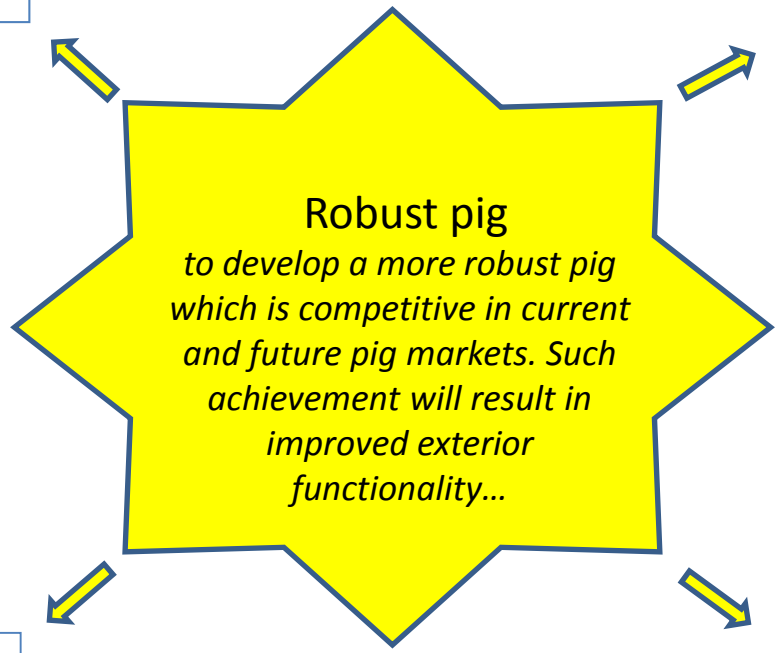
8: Development of an efficient breeding strategy to increase competitiveness nationally and internationally, from breeding, through production to meat refinement, based on the findings in sub-goals 1. to 7

7: Detected genes from sub goal 6, as well as biological candidate genes involved in robustness will be characterised in order to detect funtional SNPs

1: Evaluate the objectivity of the current system used for assessment of exterior traits



2: Promote better understanding of the complexity of exterior traits by anatomic and genetic studies

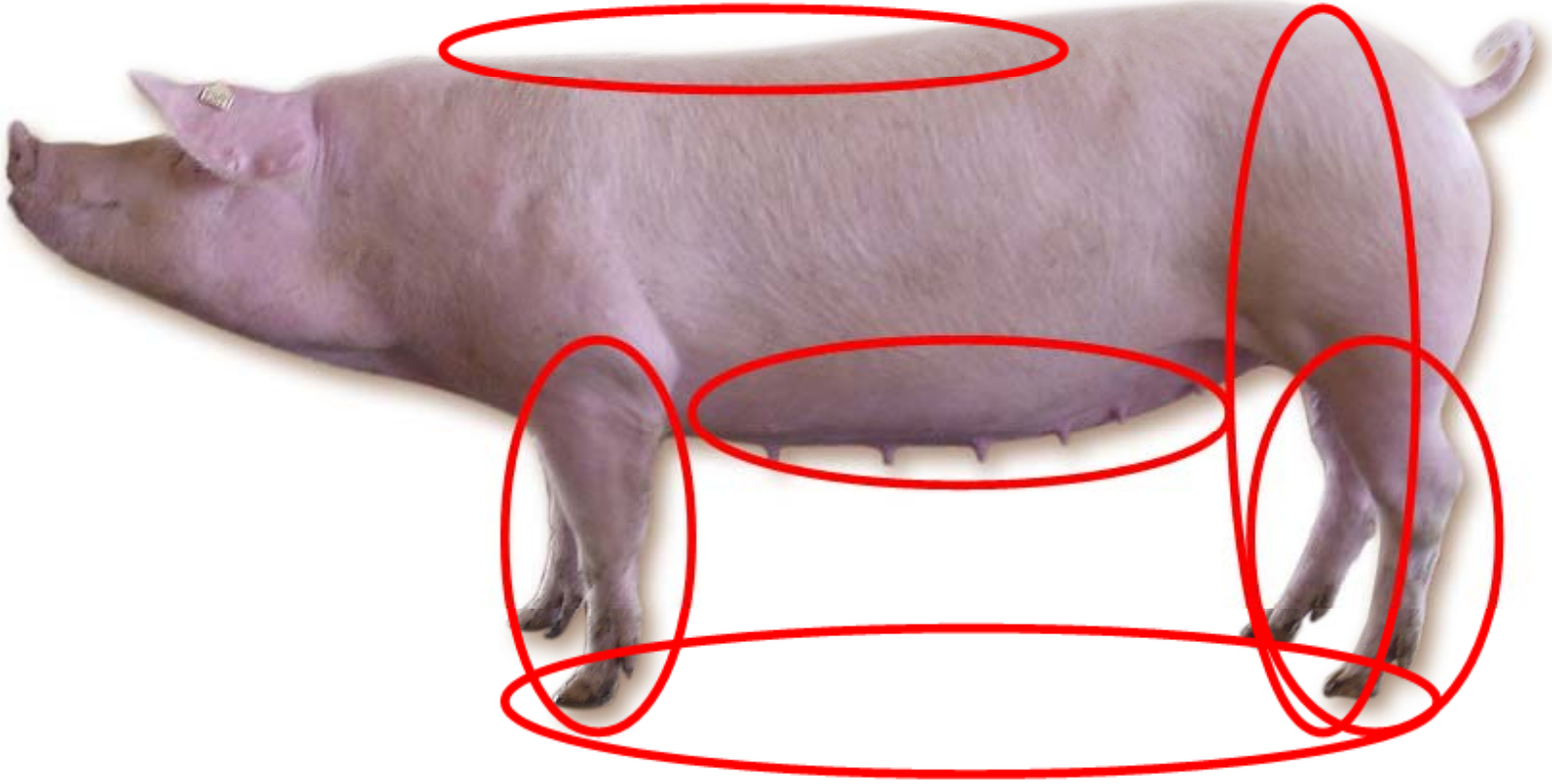
6: Identify QTL affecting all robustness and production traits recorded in the project by high-throughput genome scan

5:Develop objective evaluation of locomotion patterns by using video analyses.

4: Quantify the level and risk of osteochondrosis by using CT

3: Pilotstudy: Promote better understanding of underlying relationship between the cartilage blood supply and development of Osteochondrose (OC)

Subgoal 1 and 2: Exterior assement



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Teat quantity and quality

Off-test and boar test:
-Number of teats
-Number of teats in front of navel,
-Number of inverts,
-Number of non - normal

Boar test only:
- Distance from relaxed front leg to first teat
- Sagittal teat spacing

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Table 2. Heritabilities + s.e. for Total Number of Teats and Number of Inverted Teats in Norwegian Landrace

Trait	Heritability
Inverted Teats-Boars	0.21 ± 0.03
Inverted Teats-Gilts	0.32 ± 0.02
Total Teats-Boars	0.38 ± 0.03
Total Teats-Gilts	0.41 ± 0.02

(Long et al., 2010)

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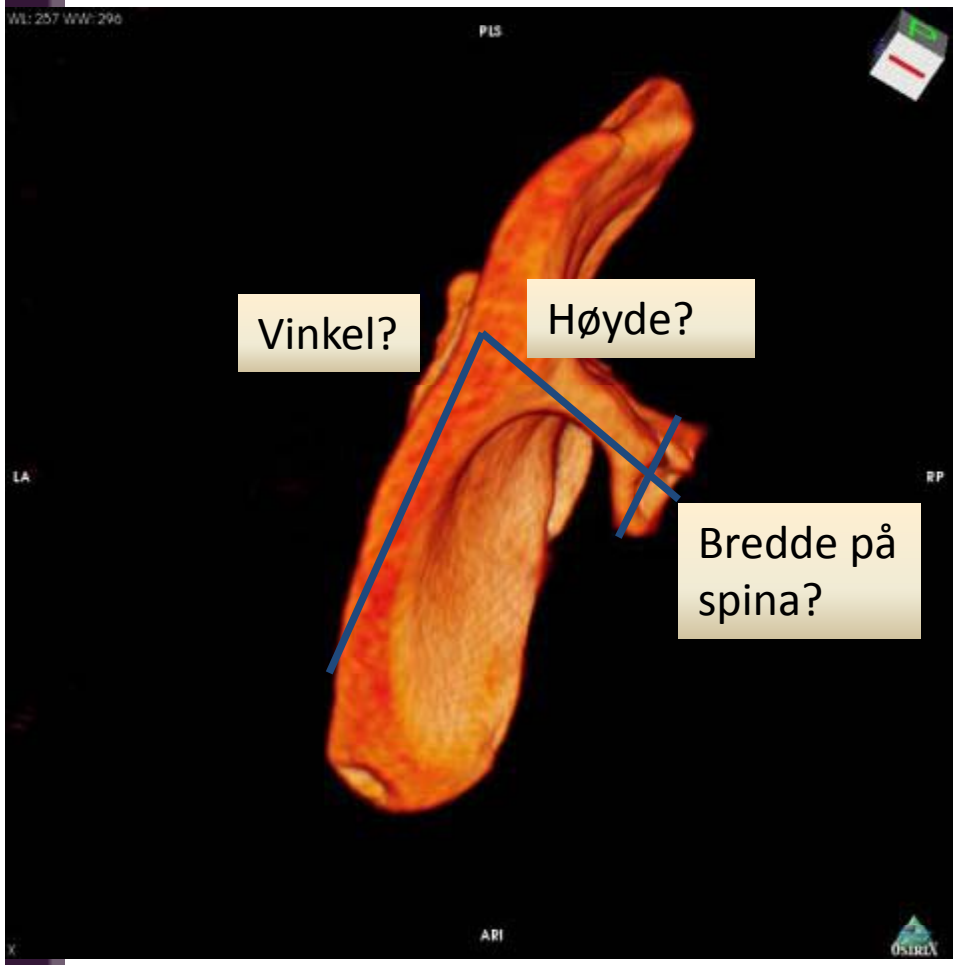
UNDERLINES

- Minimum of 14 functional teats
- Ave teat count on landrace piglets is 15.94
- Remember-Sows will lose mammary glands throughout their life

Shoulder lesions?



- Why does sows get shoulder lesions?
  - Body condition at weaning
  - «Time spendt liing down»
  - Morphology of shoulder blade?
    - Height of spina scapula?
    - Morphology of spina scapula?
    - Angle between spina og shoulder blade?

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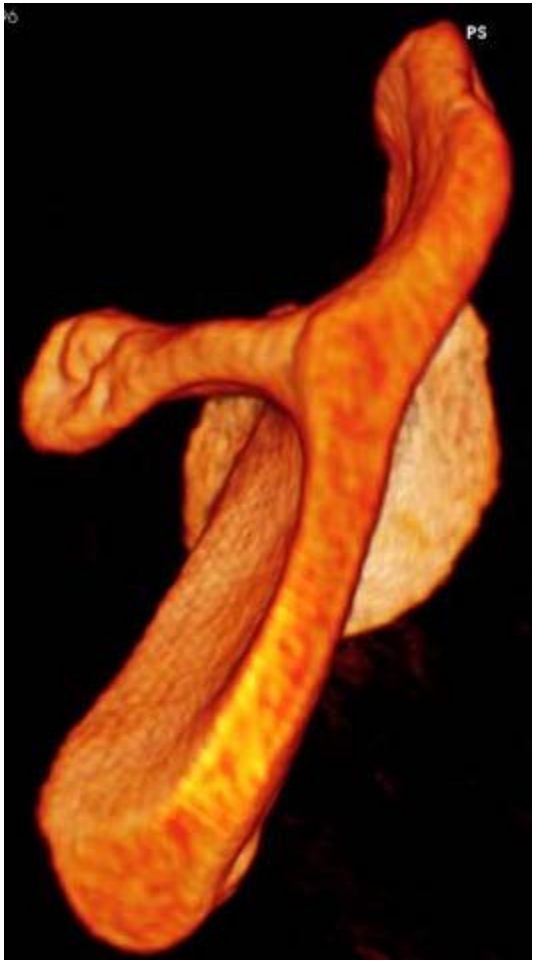
2D….3D…



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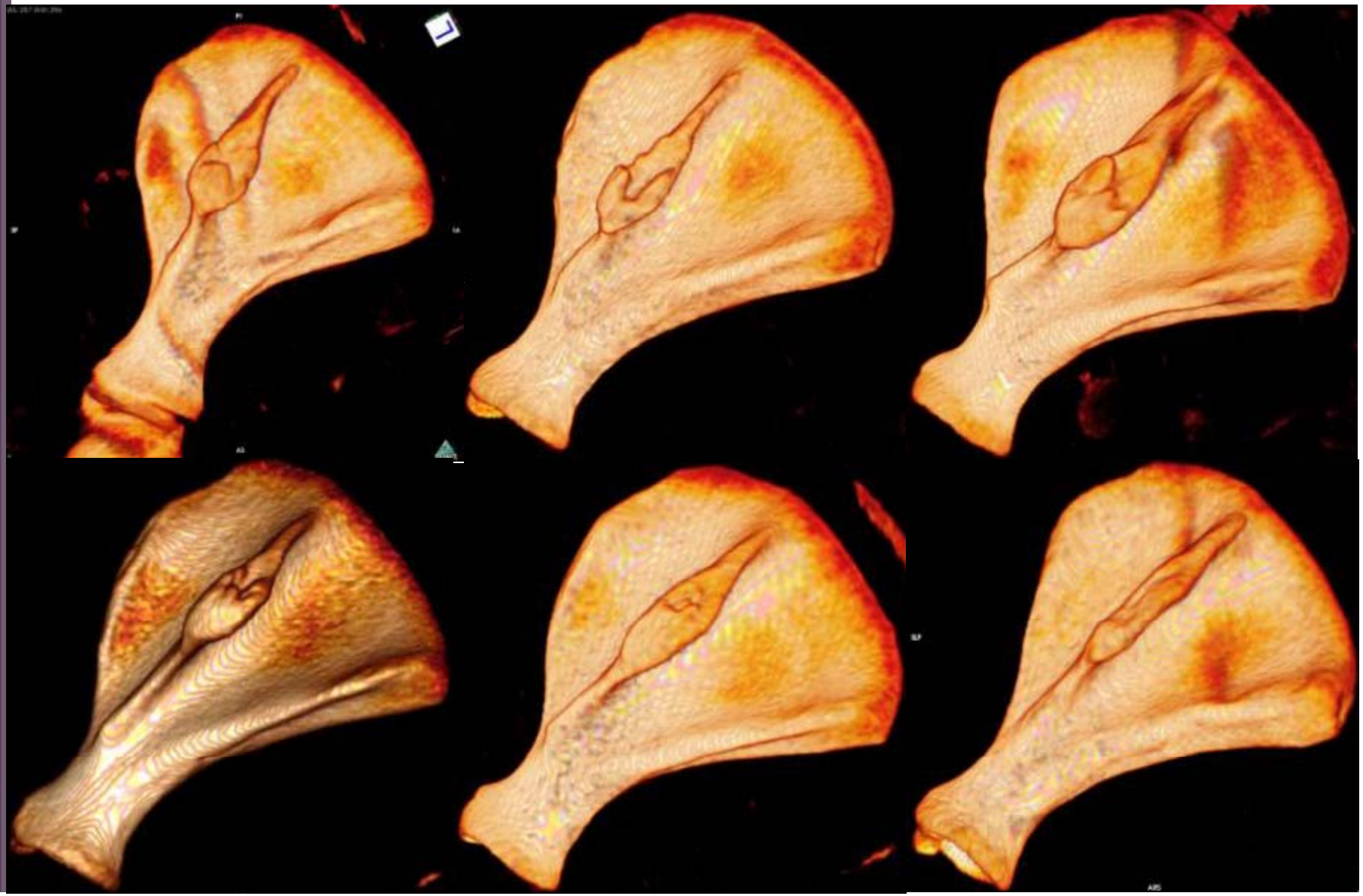
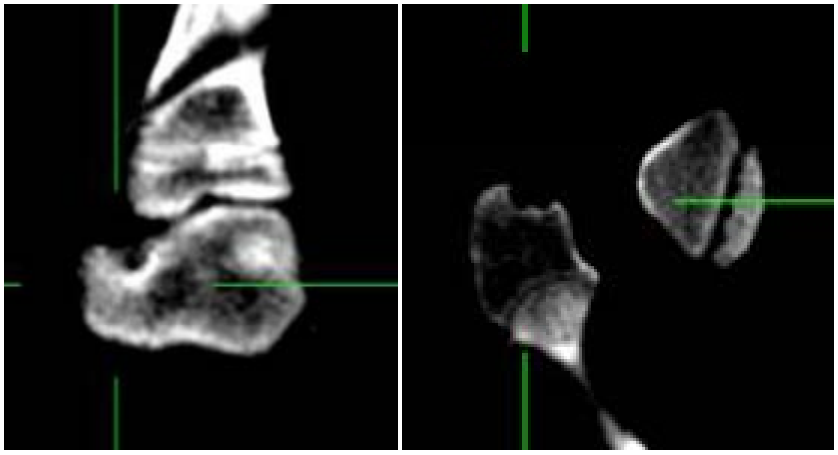
Morfologi - variasjon

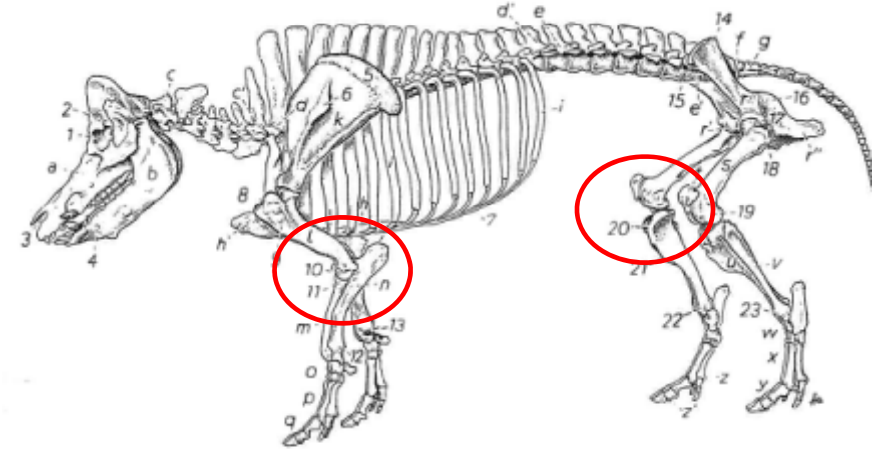


Sub goal 4: OC – Quantify the level and risk of osteochondrosis by using computed tomography (CT)

- Front leg: 2 x humerus- radius/ulna

- Hind leg: 2 x femur- tibia/fibula
  - – Lateral and medial condyle
  - - Modified Grøndalen
  - - Observes high frequency of OC at medial distal femur position





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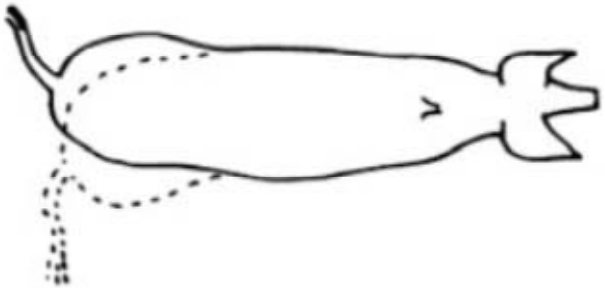
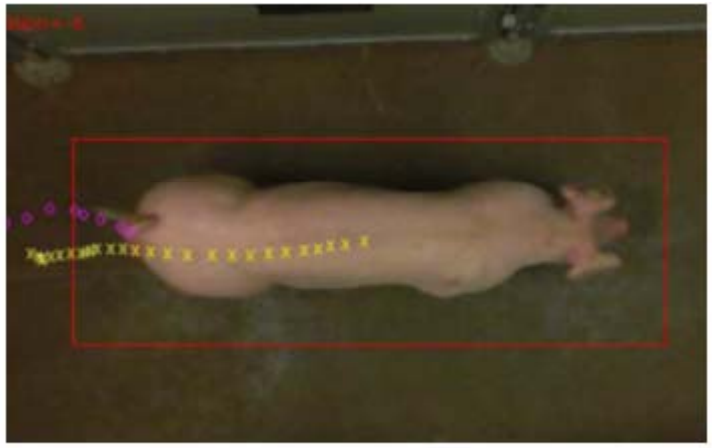
Subgoal 5: Video analysis

Goal: Collect information from still photos gathered vith a video device

Framegrabbing
Loop: Collect information from one picture
-> og to next picture
webcam4.mov





Subgoal 6

Genomanalyse

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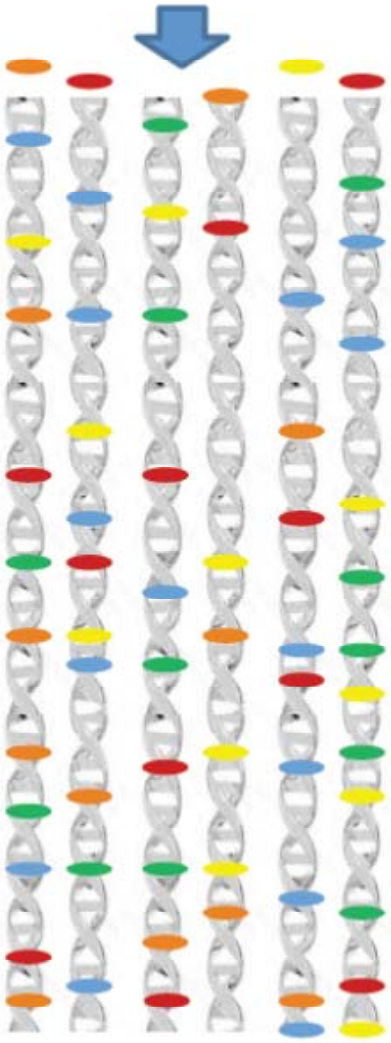
Grindflek, E. og Hamland, H.

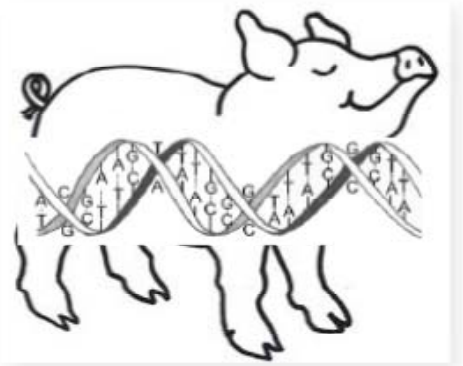
Genomet



- Osteochondrose
- Eksteriør og holdbarhet
- Produksjon
- Helse
- Andre.....

Genetiske varianter på genomet (arvematerialet) som har betydning for robusthet og andre egenskaper.

Genom-avlsverdi



Genomseleksjon

Maternal breeding goal bringing it together

	Sub Index	% weight in Total EBV	Traits	% weight in sub index	% weight in overall EBV	Heritabilities
Total EBV	Production	14 %	Feed consumption, 25-100 kg (kg)	35 %	5 %	0,36
			Age at 25 kg (days)	19 %	3 %	0,54
			Days from 25 kg to 100 kg	46 %	6 %	0,41
	Carcass Quality	15 %	Killing out percentage	34 %	5 %	0,26
			Lean meat percentage	66 %	10 %	0,54
	Meat Quality	11 %	Drip loss (percent)	73 %	8 %	0,17
			Intramuscular fat	27 %	3 %	0,46
	Litter Size	21 %	Total born (#)	67 %	14 %	0,09
			Stillborn (#)	33 %	7 %	0,07
	Reproductive ability	1 %	Weaning service interval (days)	100 %	1 %	0,08
	Maternal ability	22 %	Piglet mortality(#)	74 %	16 %	0,07
			Number of teats (#)	8 %	2 %	0,39
			Inverted teats (#)	18 %	4 %	0,40 (B), 0,36 (F)
	Robustness	17 %	Structure	50 %	8 %	-
			Osteochondrosis (points)	12 %	2 %	0,32
			Defects	11 %	2 %	-
			Shoulder sore (points)	6 %	1 %	0,22
			Body condition (points)	21 %	4 %	0,16

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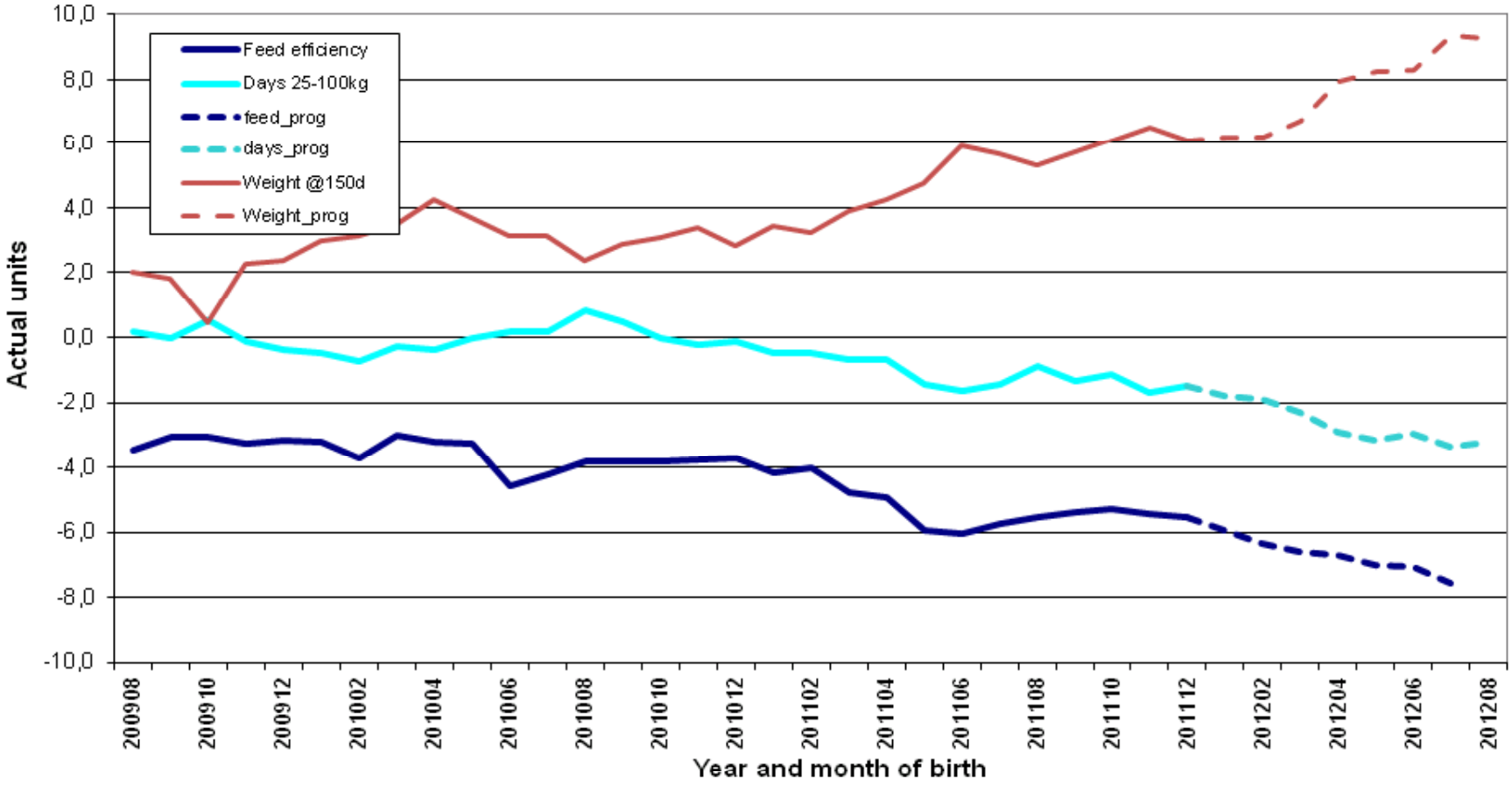
Genetic trend and prognosis

Norsvin Landrace



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High demand on capacity through maternal lines / maternal bi-products

- Sow productivity demand in loose housing:

  30+ PSY

  70% of entered gilts wean a 3rd litter

- Capacity maternal bi-products to 130kg live weight with “no” antibiotics:

  ~1000g/day

  60-61 %-lean

  2,2 FE


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MUST BE THE FEED.

Thank you for your attention