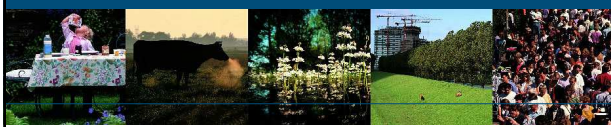


Biological Robustness of Pigs

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Background

- Global trends in pig production
 - Reduced margins
 - Scale enlargement
 - Less skilled labour available per animal
 - Increased genetic potential for production
 - Increasingly vulnerable to fluctuations in price
- Increasing concern for health & welfare problems

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Health & welfare problems

- Perception of the general public
 - Problems are substantial
 - Problems are associated with lack of robustness
 - Lack of robustness is a breeding problem
- Pig farmers & veterinarians
 - Robustness is irrelevant (for existing production systems)
 - Protect pigs from threats & challenges!

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Health & welfare problems

- Pig breeding industry
 - There is a need to resolve certain problems
 - No need for over-all concept of robustness
- Scientists
 - Academic discussion on meaning of robustness
- Policy makers
 - Need for more sustainable pig industry (triple-P)
 - Role for robust stock, but not clear how

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Dilemma: much talk, no progress

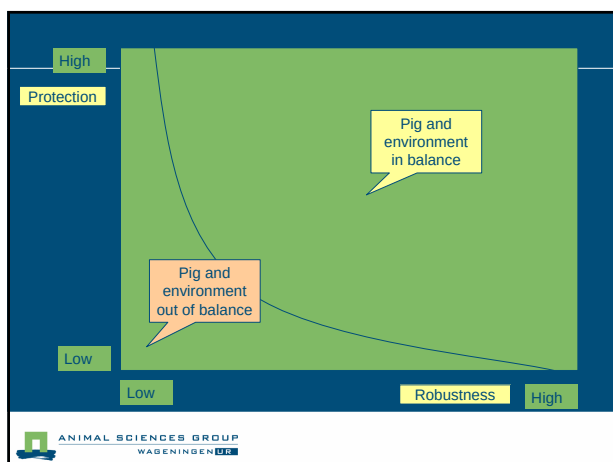
- Conflicting interests and views
- Economic pressure
- Time horizons do not match
- No shared concept of causes and possible solutions to health & welfare problems
- There is a need for a structured discussion!

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Objective

1. Provide a conceptual framework for keeping animals in balance with their environment
2. Apply this concept to pig production

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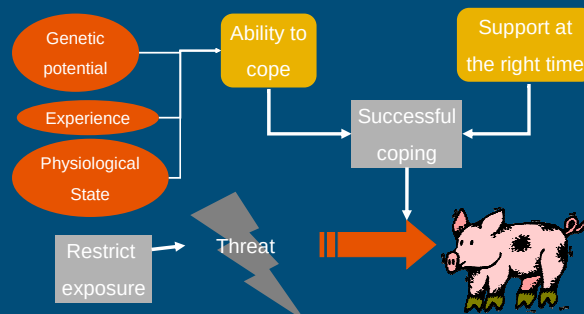
In balance with its environment

- The pig responds to a challenge and regains its homeostasis through adapting
 - Stable at the surface, but dynamic below the surface
 - "In balance" is not the same as "insensitive"
- Need to define range of threats and environments
 - Acceptable and profitable production systems
 - Normally occurring disturbances
 - "Acceptable" and "normally" are to be agreed on by all parties

A robust pig ...

... is structurally in balance with its environment in the normally occurring dynamics of acceptable and profitable production systems

Maintaining homeostasis



Successfully coping with exposure to threats

- Genetic potential is a **precondition**, but not a **guarantee** of successfully coping with exposure
- System & management play a role at **four levels**
 - Protect pig from threats
 - Allow pig to adapt by providing support
 - Allow pig to learn by doing
 - Avoid temporary vulnerability (stress, overburdening)

Protecting or allowing to cope successfully

- **Enable** the pig to cope successfully where **possible**, in case a threat should occur
- **Support** the pig in its attempts to adapt when the threat occurs
- **Protect** the pig from threats where it is **easy** or **necessary**

Problems associated with robustness of pigs

- Infectious diseases
- Overburdening
 - Metabolism & circulation
 - Feet, legs, joints and muscles
- Behavioural pathologies

Infectious diseases: current situation

- Outbreaks of infectious diseases are a significant problem
- Diseases rarely fade away on a unit
- No evidence for increase in general sensitivity
- Potential impact is greater because of scale enlargement

Infectious diseases: threats

- Production system
 - All ages at any point in time & high density
 - Chronic stress suppresses immune response
- High level of production
 - Hypothetically through resource allocation problems
- Genetic selection
 - High rate of inbreeding may increase sensitivity to a specific disease

Infectious diseases: solutions I

- Protecting pigs from threat
 - Optimal biosecurity
- Genetic potential
 - Crossbreeding
 - Selection against any specific disease is possible
- Learn by doing
 - Vaccination
 - Natural exposure with protection
 - Stable microflora

Infectious diseases: solutions II

- Supporting the pig's attempts to cope
 - Increased ambient temperature (micro-climates?)
 - Change of feed?
- Avoiding temporary vulnerability
 - Avoiding chronic stress
 - Avoiding draught or being too cold

Overburdening: current situation

- Problems vary somewhat per line
- Metabolism & circulation
 - Negative E and N balance, heart failure, low appetite, etc
 - Not a substantial problem in pigs
- Conformation
 - Problems with feet, legs, joints, muscle, back, etc
 - Significant problem in pigs

Overburdening: threats

- Production system
 - High ambient temperatures
 - Sub-optimal management
 - Poor feed quality
 - Poor housing facilities
- High level of production
 - Hypothetically through resource allocation problems
- Genetic selection
 - Strong selection for growth efficiency and milk production in favourable environment may increase sensitivity

Overburdening: solutions I

- Protecting pigs from threat
 - Adhere to minimum standards for housing, feeding and management
- Genetic potential
 - Artificial selection on indicator traits
 - Natural selection in representative selection environment
- Learn by doing
 - Hypothetically: rearing & production in similarly challenging environments

Overburdening: solutions II

- Supporting the pig's attempts to cope
 - Improve conditions to relieve pressure on pig
- Avoiding temporary vulnerability
 - Protect pigs with a disease or injury
 - Protect pigs in periods of peak demands

Behaviour & chronic stress: current situation

- Problems are substantial in most common production systems
- Behavioural pathologies
 - Tail-biting
 - Bar-chewing
- Chronic stress response: elevated cortisol levels
- Interpretation: arise from frustration
 - Not being allowed to adapt
 - Not being allowed to express behavioural needs

Behaviour & chronic stress: threats

- Production system
 - Overstocking
 - One single climate
- High level of production
 - Indirect: inability to adapt because of painful feet or joints
- Genetic selection
 - Indirect effect on coping style and fearfulness (hypothesis)

Behaviour & chronic stress: solutions I

- Protecting pigs from threat
 - Remove chronic nature of stressors
- Genetic potential
 - Artificial selection against damaging behaviour
 - Risk of selection for insensitivity to poor housing and management
- Learn by doing
 - Allow the pig during rearing to get used to adapting to changes

Behaviour & chronic stress: solutions II

- Supporting the pig's attempts to cope
 - Improve conditions to allow successful adaptation
- Avoiding temporary vulnerability
 - Protect pigs with a disease or injury
 - Protect pigs in periods of peak demands

Be aware ...

- This is an **illustration** of a concept as starting point of meaningful discussion
- Many aspects are **hypotheses** and need further study
- Many aspects require **re-design of production systems** for utilisation of robustness of pigs
- Utilising robust pigs can contribute to a **more robust pig herd and pig industry**, but no guarantee

Conclusions

- Utilising robust pigs is a problem of both **potential** and **expression**
- Aim is not robustness but **structural balance**
- Main areas are **infectious diseases**, **overburdening** and **chronic stress**
- Environment plays a role in keeping the balance in **four different ways**

Conclusions

- A robust pig ...
 - Has the **genetic potential** to deal with challenges effectively
 - Has **learned to use** its genetic potential effectively
 - Is **enabled to use** its ability and experience whenever it is required

A thank-you to ...

Luc Janss
Kees van Reenen
Bas Kemp
Karel de Greef
... among others
for discussion