健康畜禽 Healthy Livestock

Early life experiences affect the adaptive capacity of animals to cope with challenges later in life

BAS KEMP & HANS SPOOLDER

WAGENINGEN UNIVERSITY
WAGENINGEN UR

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Examples of perinatal conditions on later adaptive capacity in farm animals

- **Prenatally**
  - Stress in the mother hen leads to offspring feather pecking
  - Maternal priming with LPS leads to high humoral offspring response
  - High incubation temperatures lead to ascites in offspring
  - Flavour learning
- **Early postnatal**
  - Early feeding in chicken leads to better growth and humoral defence
  - Learning piglets to be prepared for weaning




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Weaning of pigs: a critical transition with loss of adaptive capacity

- **Health and performance**
  - Low nutrient intake
  - Poor growth rate or even weight loss
  - Impaired intestinal functioning, diarrhoea

- **Welfare**
  - Stress response
  - Maladaptive behaviours

Learning piglets to be prepared for weaning

- **Ways to improve learning of piglets:**

Stimulatory effects of the sow

- Flavour learning in piglets
- Learning from mom

Stimulatory effects from the environment

- Environmental enrichment
- Big pellets for small piglets
- Diversity in feed items

Flavour learning & performance post-weaning

- **Piglets perinatally exposed to flavour sow's feed**
  - Lower cortisol response and less vocalisation
  - Higher feed intake and higher growth
  - Less diarrhoea and less damaging behaviours

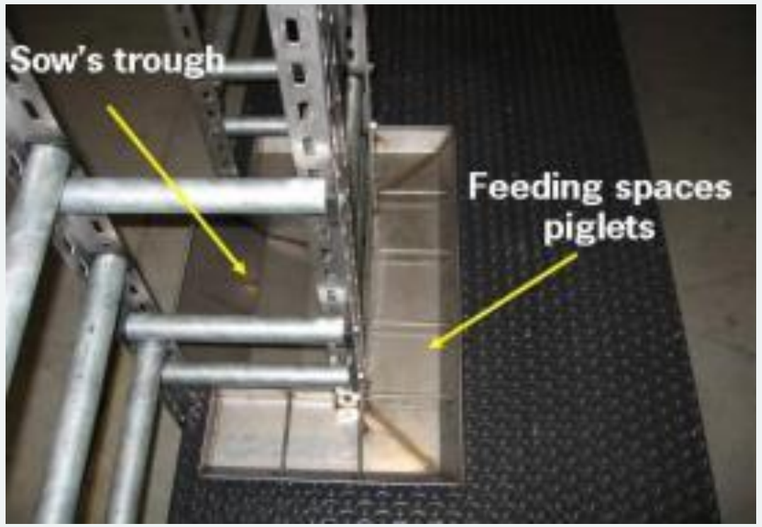
… If flavour was present in post-weaning environment



Bolhuis et al, 2009 VFI in Pigs;
Oostindjer et al., 2009 Chem Sens;
2010 Physiol Behav; 2011 Plos ONE

Learning from mom

- Piglets should be able to participate in or at least to observe the sow eating
- Piglets prefer a similar flavoured sow feed
- Piglets prefer to eat at the same feeder as the sow



Oostindjer et al. 2011, An. Behav.

Environmental enrichment

- **Before weaning**
  - Reduced food neophobia, increased growth pre-weaning and feed intake first 2 days post-weaning
- **After weaning**
  - Increased growth, feed efficiency, play behaviour, reduced diarrhoea and damaging behaviour



Oostindjer et al. 2010 J Anim Sci; 2011 Physiol Behav; 2011 Appl Anim Behav Sci

Environmental enrichment

- Reduces maladaptive behaviours
- Improves performance
- Improves the resilience against disease

	Barren BHI pigs (%)	Enriched EHI pigs (%)	p-value[1]
Pigs with lung lesions	57.1	7.1	<0.05

Piglets were housed enriched or barren for birth onwards

Infection model:

14 days after weaning PRRSv challenge

22 days after weaning APP challenge

Dixhoorn et al., PLOS one 2016

Outcome of the challenge

Gross Pathology and Bacteriology	Barren	Enriched	P- value
Gross Pathology			
Pigs w. App-induced lesions (%)	57.1%	7.1%	<0.05
Histology	Mean ± SEM	Mean ± SEM	
Extent of pulmonary lesions	8.07 ± 0.87	3.5 ± 0.5	<0.0001
Severity of pulmonary lesions	9.71 ± 0.94	6.86 ± 0.49	<0.05
Pleuritis	4.57 ± 1.17	0.71 ± 0.27	<0.005
Peri-bronchiolar and peri-vascular infiltrates	3.86 ± 0.7	1.43 ± 0.33	<0.005

Larger pellets for small piglets

Pellet size

Larger pellet diameters during lactation:

- Are preferred by young piglets
- Increase early pre weaning feed intake
- Increase feed intake, weight gain and feed efficiency post weaning
- This suggest that an early onset of feeding may facilitate coping with the weaning process

12 vs 2 mm pellets during lactation:

14 % better feed intake,
26% higher weight gain,
first 10 days after weaning

Van den Brand et al., 2015

Diet diversity stimulated feed intake during lactation

Diet A

Diet B

Only diet A was provided or both diets were provided from 2 days of age

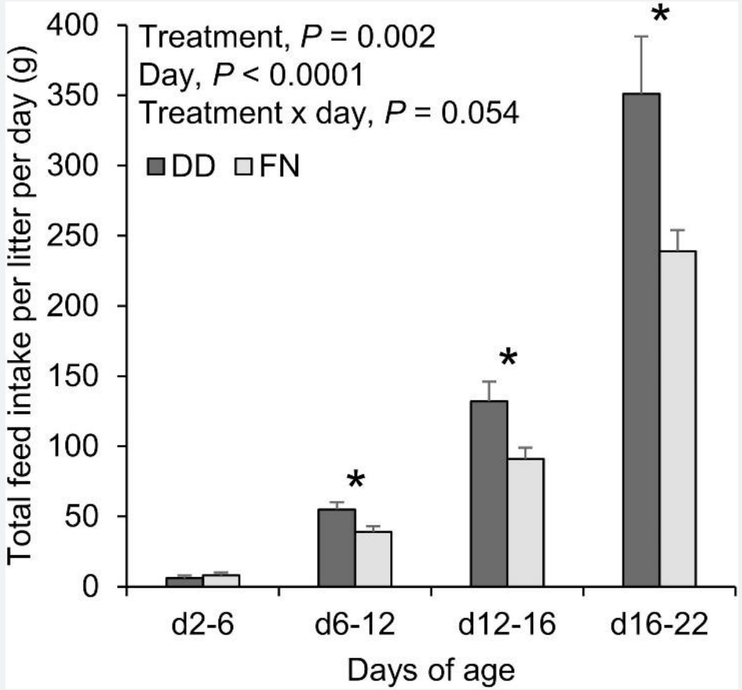
Diets differ in composition, size of pellets, hardness, smell and taste

Middelkoop et al., 2018

Effects both diets (DD) or only diet A (FN)

Total feed intake per litter per day

- Diversity in diet stimulates feed intake of piglets during lactation
- Extra feed intake is not due to preference to diet B.



Middelkoop et al., 2018

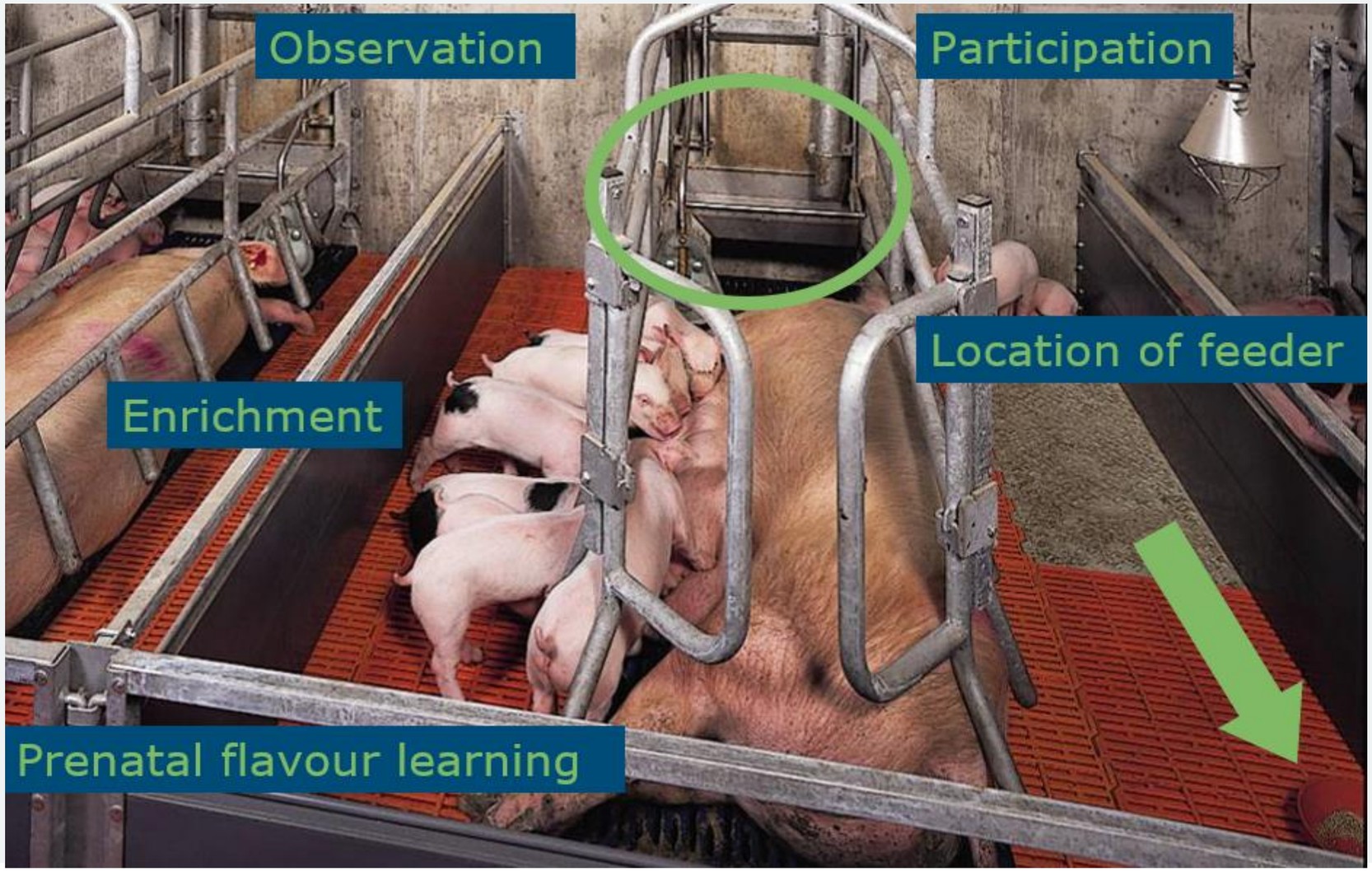
Take home messages

Pigs are better prepared for weaning if:

- You allow sows to learn piglets to eat (flavour learning, eating together, similar flavoured feeds near the place where the sow eats)
- You apply various forms of environmental enrichment
- If you apply big pellets and variation in fed items
- Provided diversity in the diet

It will improve the adaptive capacity of piglets during and after weaning

From science to practice



Thank you!

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Foetal origin of adult disease (DPJ Barker)

Coronary heart disease and type 2 diabetes may originate from low birth weight and foetal undernutrition

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Reproductive Toxicology 20 (2005) 345–352

Reproductive Toxicology

www.elsevier.com/locate/reprotox

Review

Prenatal exposure to the Dutch famine and disease in later life: An overview

Rebecca C. Painter[a,*], Tessa J. Roseboom[a], Otto P. Bleker[b]

[a] *Department of Clinical Epidemiology and Biostatistics, Academic Medical Centre, University of Amsterdam, Amsterdam, The Netherlands*
[b] *Department of Obstetrics and Gynecology, Academic Medical Centre, University of Amsterdam, Amsterdam, The Netherlands*

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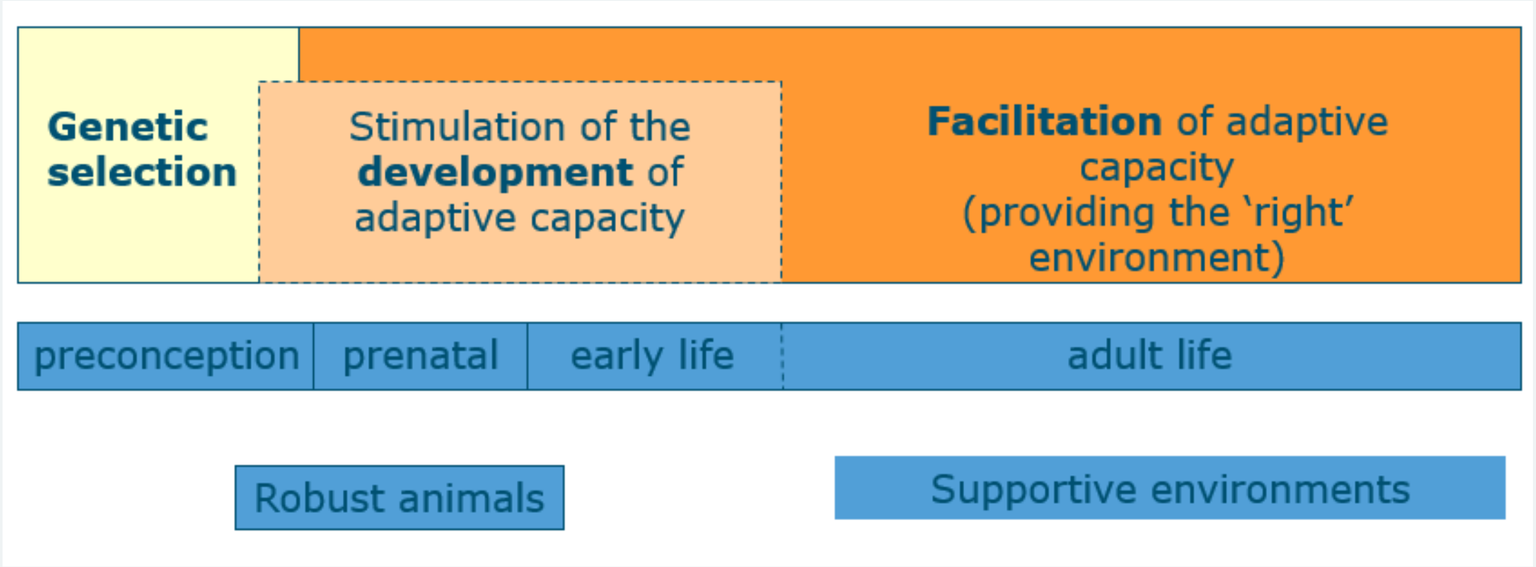
Determinant of Adaptive Capacity

- Overview of different methods (**selection, development, facilitation**) to improve adaptive capacity of animals.

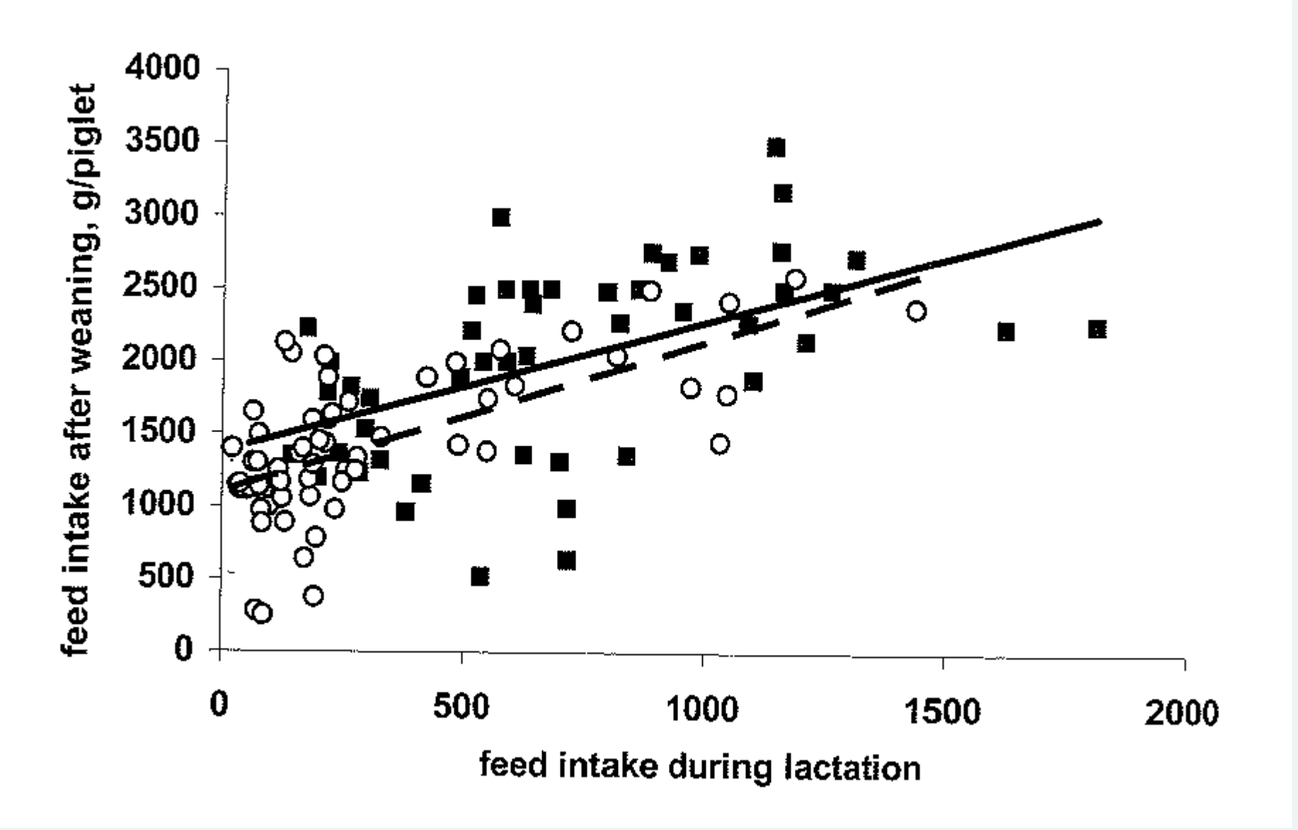


Enriched vs barren: effects on a challenge

- 14 days after weaning PRRSv challenge
- 22 days after weaning APP challenge

  - PRRSv: Porcine Reproductive and Respiratory Syndrome virus
  - APP: Actinobacillus Pleuropneumoniae
  - Model for multifactorial lung challenge

Feed intake before and after weaning



27 days lactation, creep feed from 7 days, feed intake after weaning first 7 days (g/piglet)

Kuller et al., 2004, JAS

Why learn piglets to eat during lactation?

- **Preparing piglets during the lactation period**

  - Pigs that eat more during lactation eat more after lactation
  - Less weaning associated problems
  - 12-66% piglets does not eat before weaning (VIC:30%)

  - Focus on learning how and what to eat during lactation