

# **Danish Experience**

## **Control of neonatal diarrhea**

DVM Andreas Birch, Ø-Vet

4<sup>th</sup> of September 2025.

## Andreas Birch

DVM in 1999 from Royal Veterinary and Agricultural University in Copenhagen

Mixed practice for 3 years

Specialized swine practice since 2003

Co-owner of Ø-Vet since 2010

*Ø-Vet is a group of specialized swine veterinarians.*

*We have 7 owners and 4 employed vets.*

*The daily work is farm visits in Denmark and Europe*

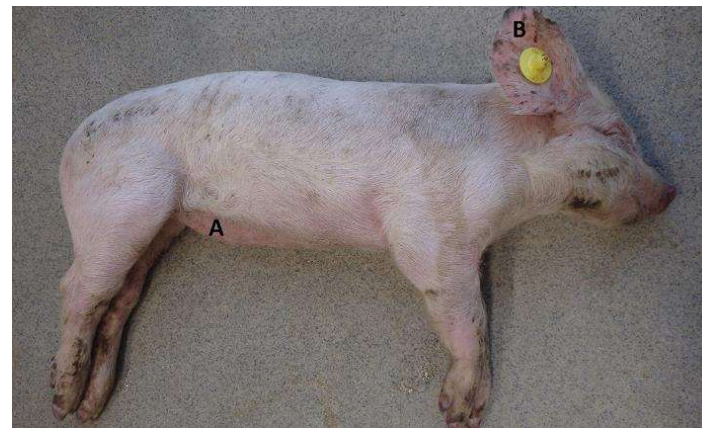


[ab@oebet.dk](mailto:ab@oebet.dk), +45 4021 6072

**Pre-weaning diarrhea** in the **farrowing** unit

**Post-weaning** intestinal infections in the **nursery**

**Late** infections in the **finishers**







**New Neonatal Porcine Diarrhea Syndrome in Denmark**  
Characterization of the intestinal lesions and identification of the etiology

PhD Thesis by  
Beata Jonach  
2014

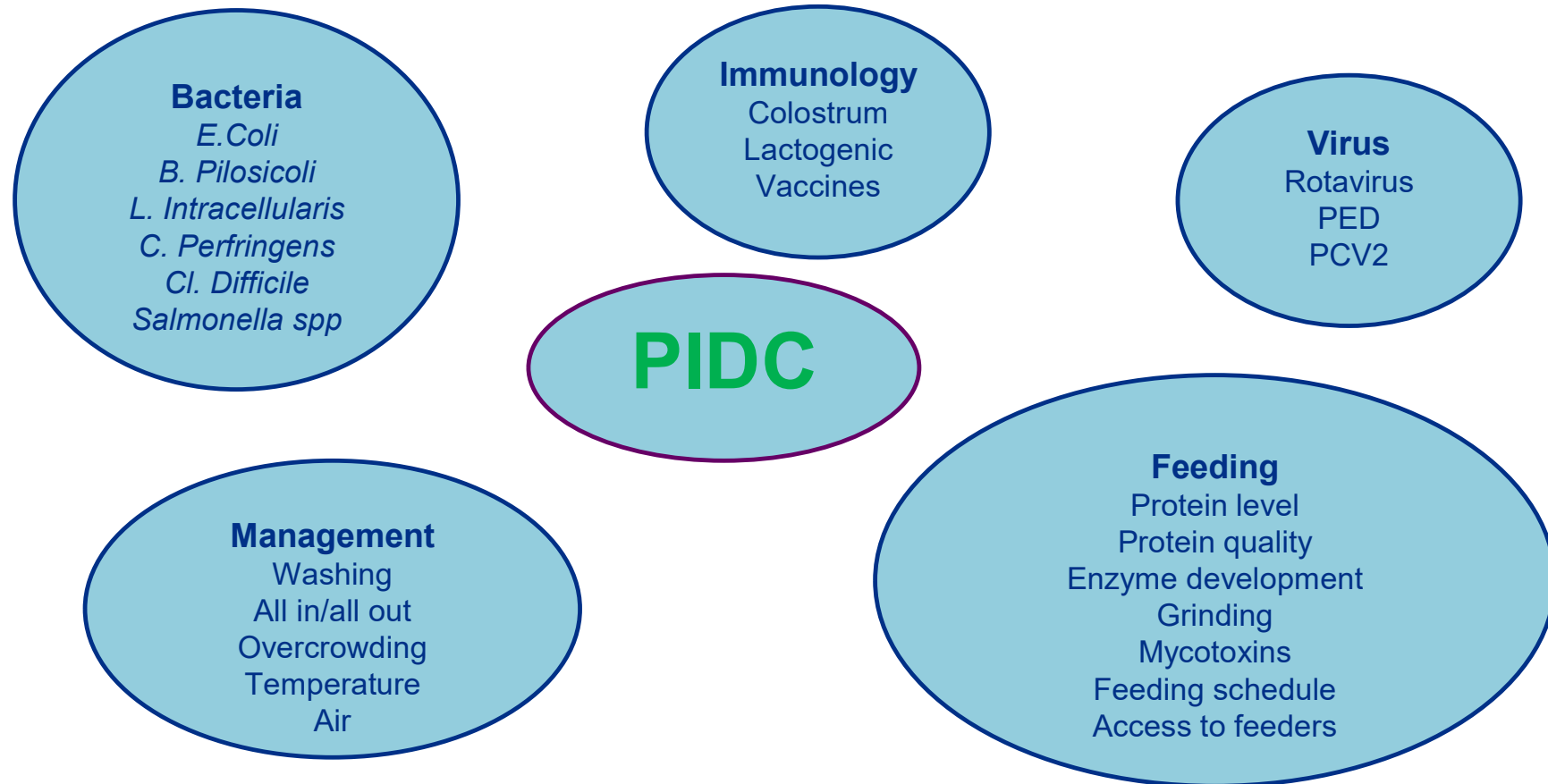
Technical University of Denmark  
National Veterinary Institute  
Section for Bacteriology, Pathology and Parasitology  
Copenhagen

PhD thesis

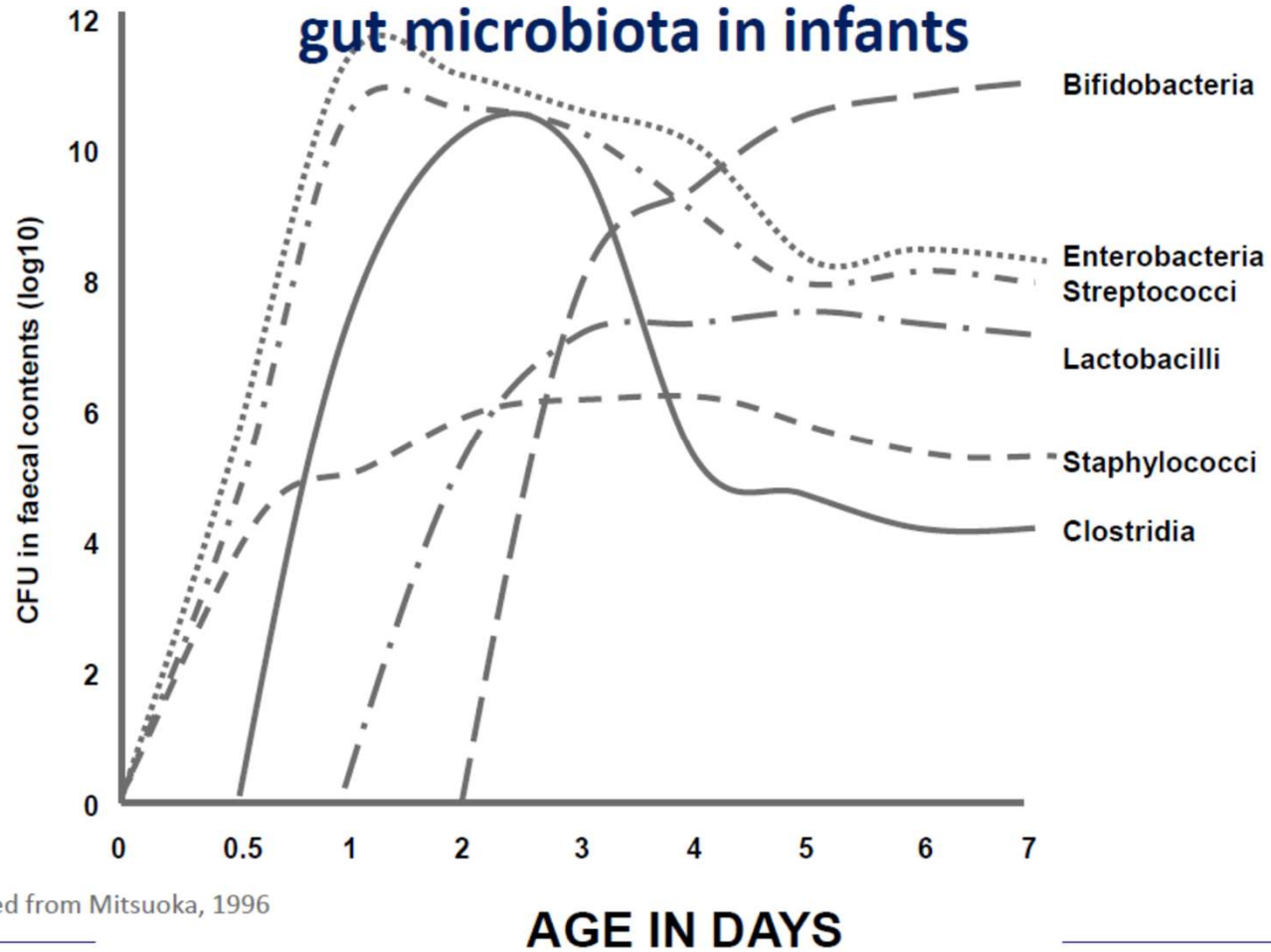
No new pathogens found.  
No clear cause from known pathogens

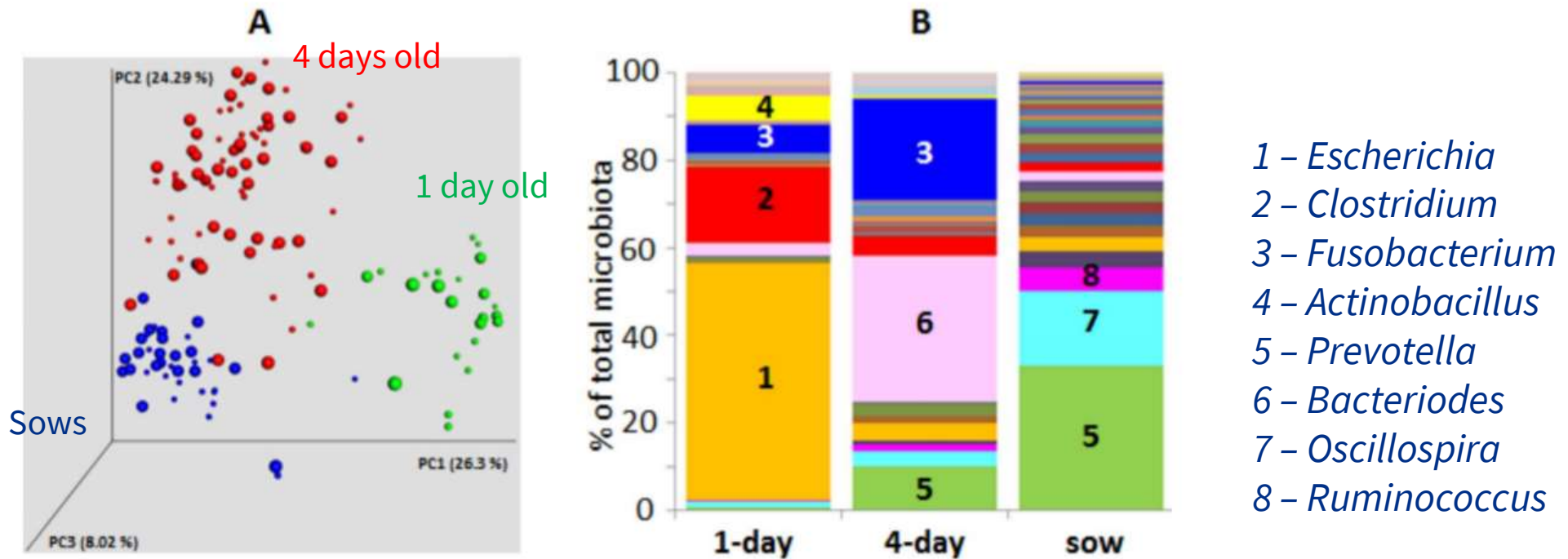
Conclusion was that we had to do focus on the sow and the immunity.

# Porcine Intestinal Disease Complex



Developmental trajectory of fecal gut microbiota in infants

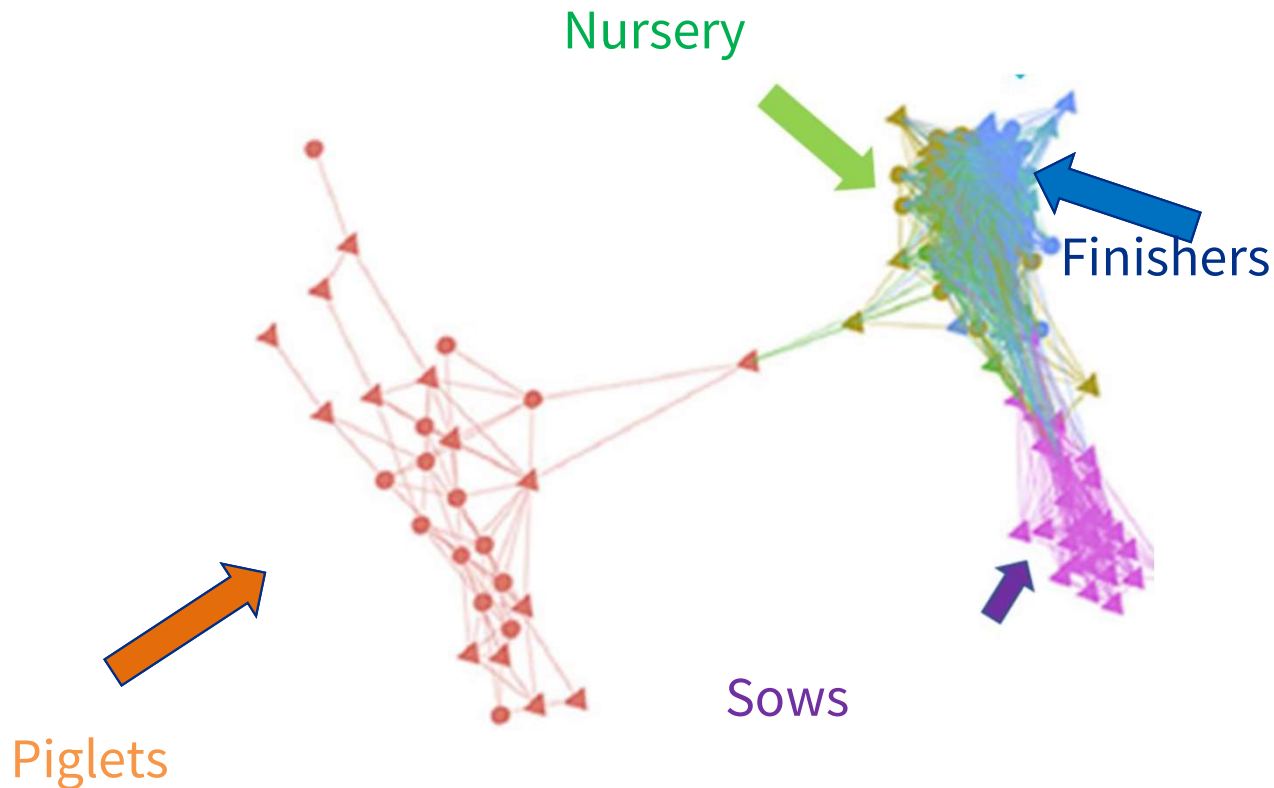




**Fig 1. Microbiota composition in sows, 1- and 4-day-old piglets.** Panel A, weighted PCoA analysis of microbiota composition in sows (blue spots), 1-day-old piglets (green spots) and 4-day-old piglets (red spots). Smaller spots—microbiota of sows kept under conventional conditions with slatted floor, or of piglets delivered by these sows. Bigger spots—microbiota of sows kept in enriched pens with floor covered with straw bedding, or of piglets delivered by these sows. Panel B, composition of fecal microbiota of 1-day-old piglets, 4-day-old piglets and sows at the time of farrow 1—*Escherichia*, 2—*Clostridium*, 3—*Fusobacterium*, 4—*Actinobacillus*, 5—*Prevotella*, 6—*Bacteroides*, 7—*Oscillospira*, 8—*Ruminococcus*. For all genera, see S1 Table.

doi:10.1371/journal.pone.0170051.g001

Kubasova et al., 2017



Microbiota is dynamic and mainly influenced by:

Feed ingredients

Age

But also:

Antibiotics

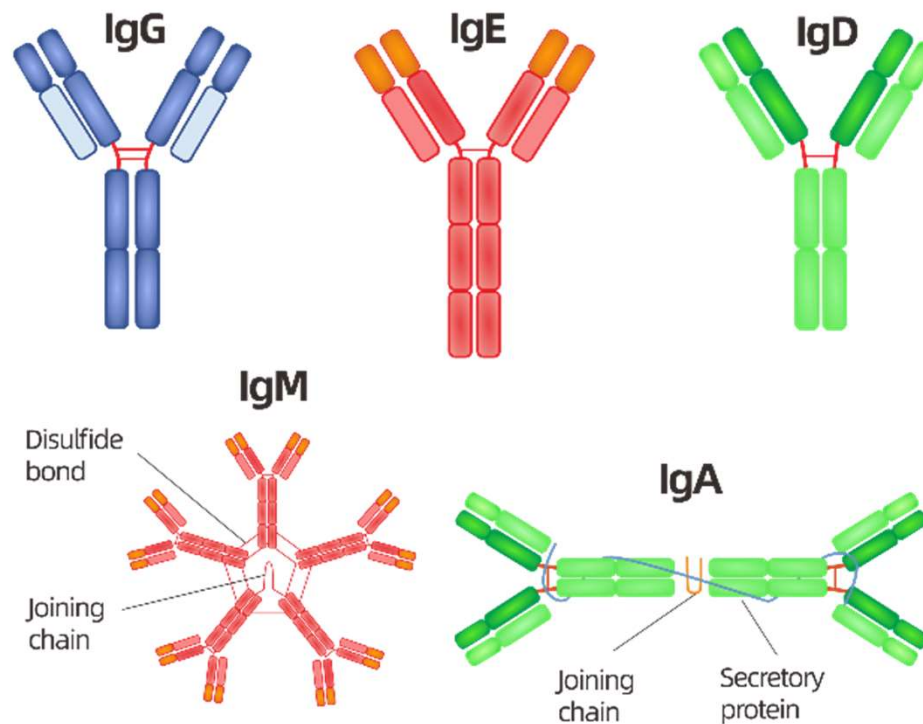
ZnO

Organic acids

Probiotics like lactobacilli are dependant of soluble fibers

Mach et al., 2015

# Control of the microbiota

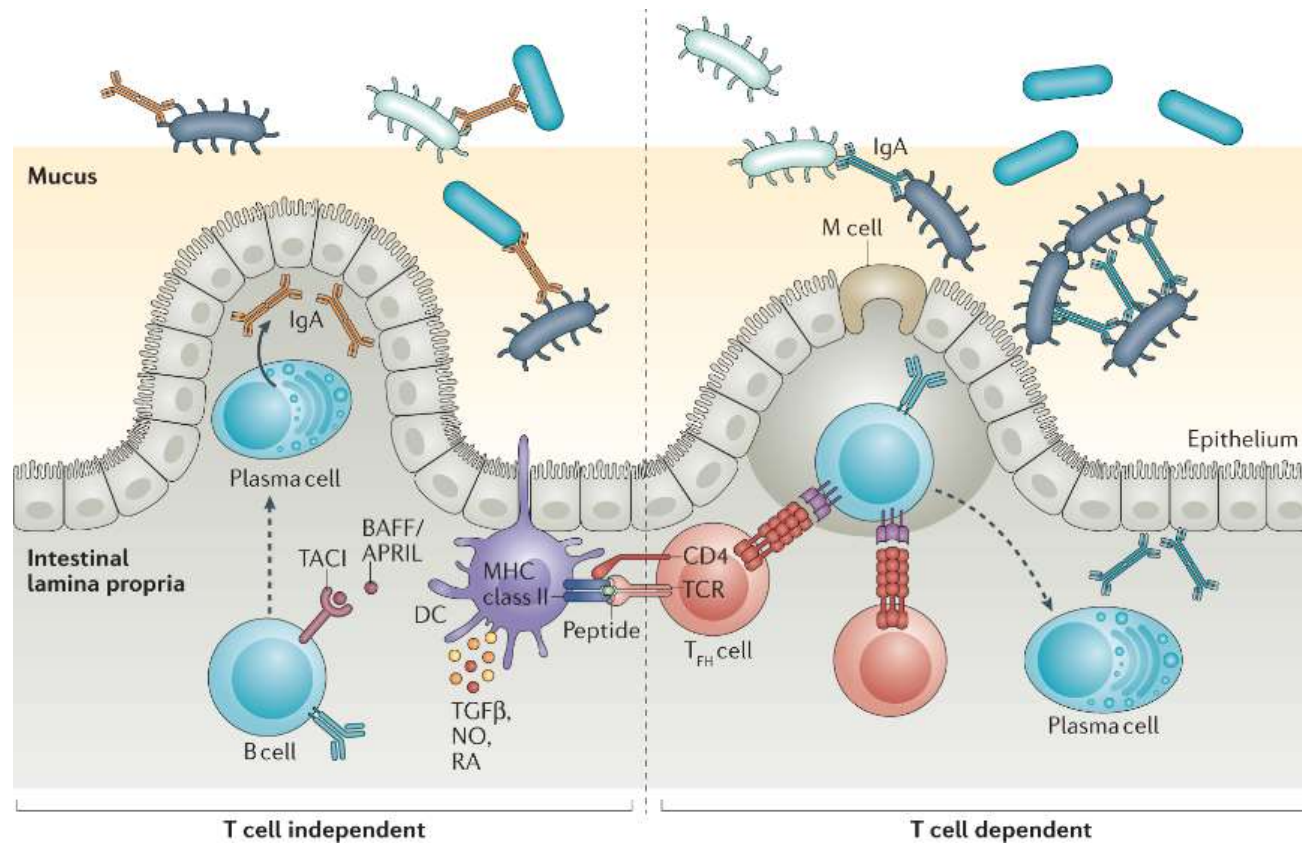


**IgG:** Rapid uptake via colostrum. Circulating in the blood and can reach most organs.

**IgM:** Circulating in the blood and is most effective against blood infections.

**IgA:** Low level in serum but high in mucosa.

From: [Antibodisystem.com](http://Antibodisystem.com)



IgA is the main immunoglobulin in the GI-tract and other mucosal surfaces

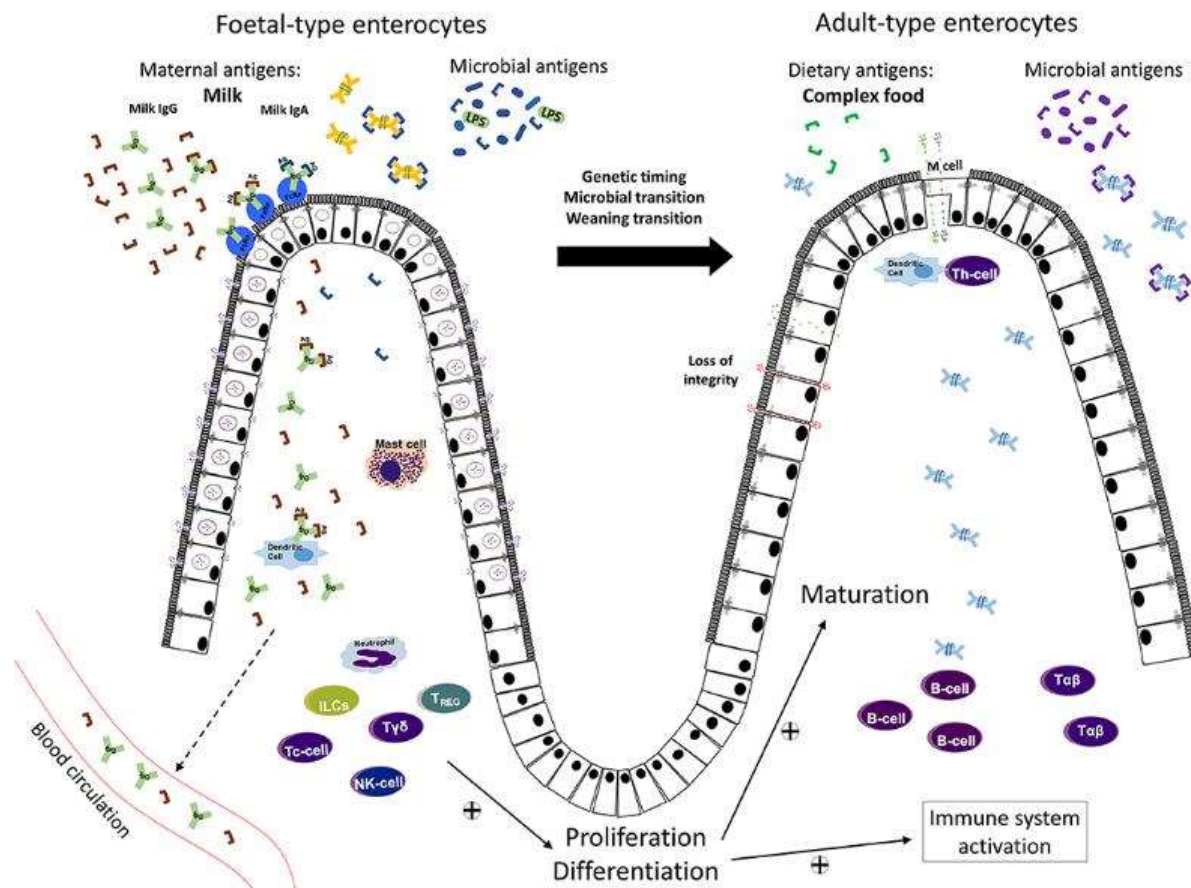
From Nature.com

## Gut closure:

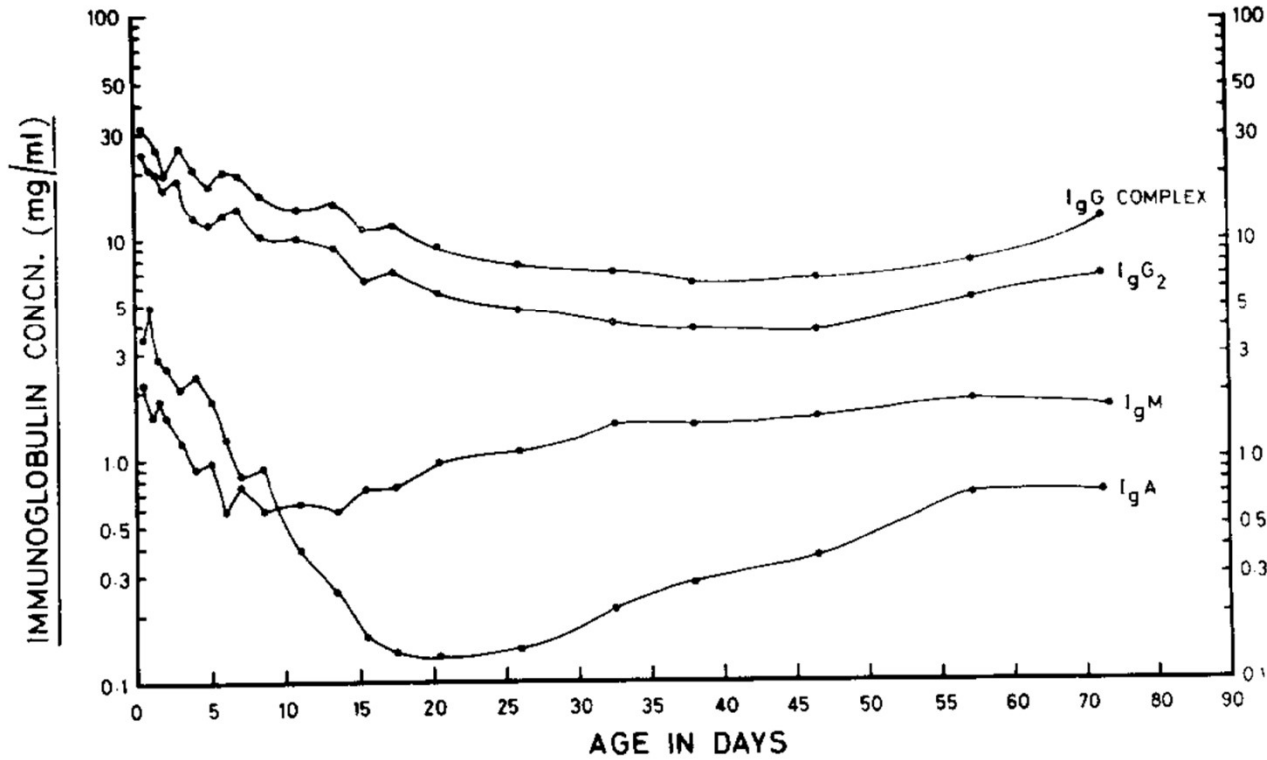
Begins 12h after birth and is completed 1-3 days after.

Maternal immunity from IgG is dependent of gut closure  
Maternal immunity from IgA is independent

B. Weström et al 2020



IMMUNOGLOBULIN QUANTITATION IN PIG BODY FLUIDS



Jill Curtis and F.J Bourne 1970

TABLE I

IMMUNOGLOBULIN LEVELS IN SERUM, COLOSTRUM AND MILK

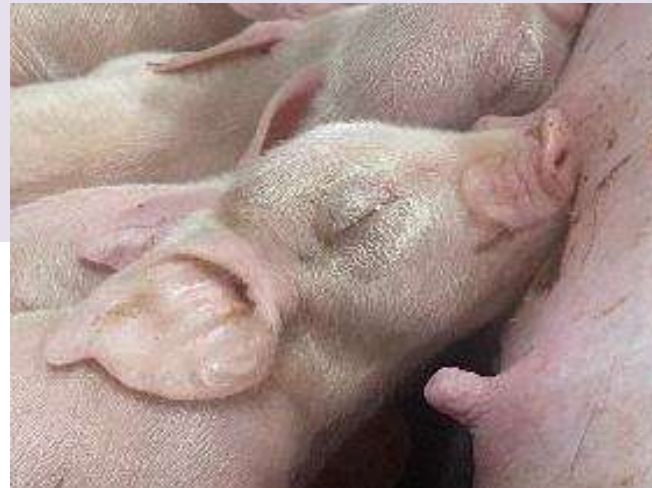
	Number of samples	Mean immunoglobulin concentration (mg/ml) $\pm$ S.E.			
		IgG	IgG <sub>2</sub>	IgA	IgM
Serum from pork pigs	27	18.31 $\pm$ 0.67	12.41 $\pm$ 0.48	1.44 $\pm$ 0.12	3.15 $\pm$ 0.19
Sow serum	28	24.33 $\pm$ 0.94	14.08 $\pm$ 0.49	2.37 $\pm$ 0.20	2.92 $\pm$ 0.18
o-h colostrum	24	61.80 $\pm$ 2.44	40.29 $\pm$ 1.66	9.66 $\pm$ 0.59	3.19 $\pm$ 0.21
Milk, 24 h	6	11.83 $\pm$ 4.82	8.04 $\pm$ 3.21	3.76 $\pm$ 0.99	1.79 $\pm$ 0.31
Milk, 2 days	6	8.16 $\pm$ 3.17	5.02 $\pm$ 1.80	2.72 $\pm$ 0.67	1.81 $\pm$ 0.41
Milk, 3-7 days	9	1.91 $\pm$ 0.64	1.31 $\pm$ 0.32	3.41 $\pm$ 1.01	1.17 $\pm$ 0.23
Milk, 8-35 days	12	1.37 $\pm$ 0.62	0.99 $\pm$ 0.45	3.04 $\pm$ 0.74	0.89 $\pm$ 0.25

Colostrals / Maternal immunity

Lactogenic immunity

Jill Curtis and F.J Bourne 1970

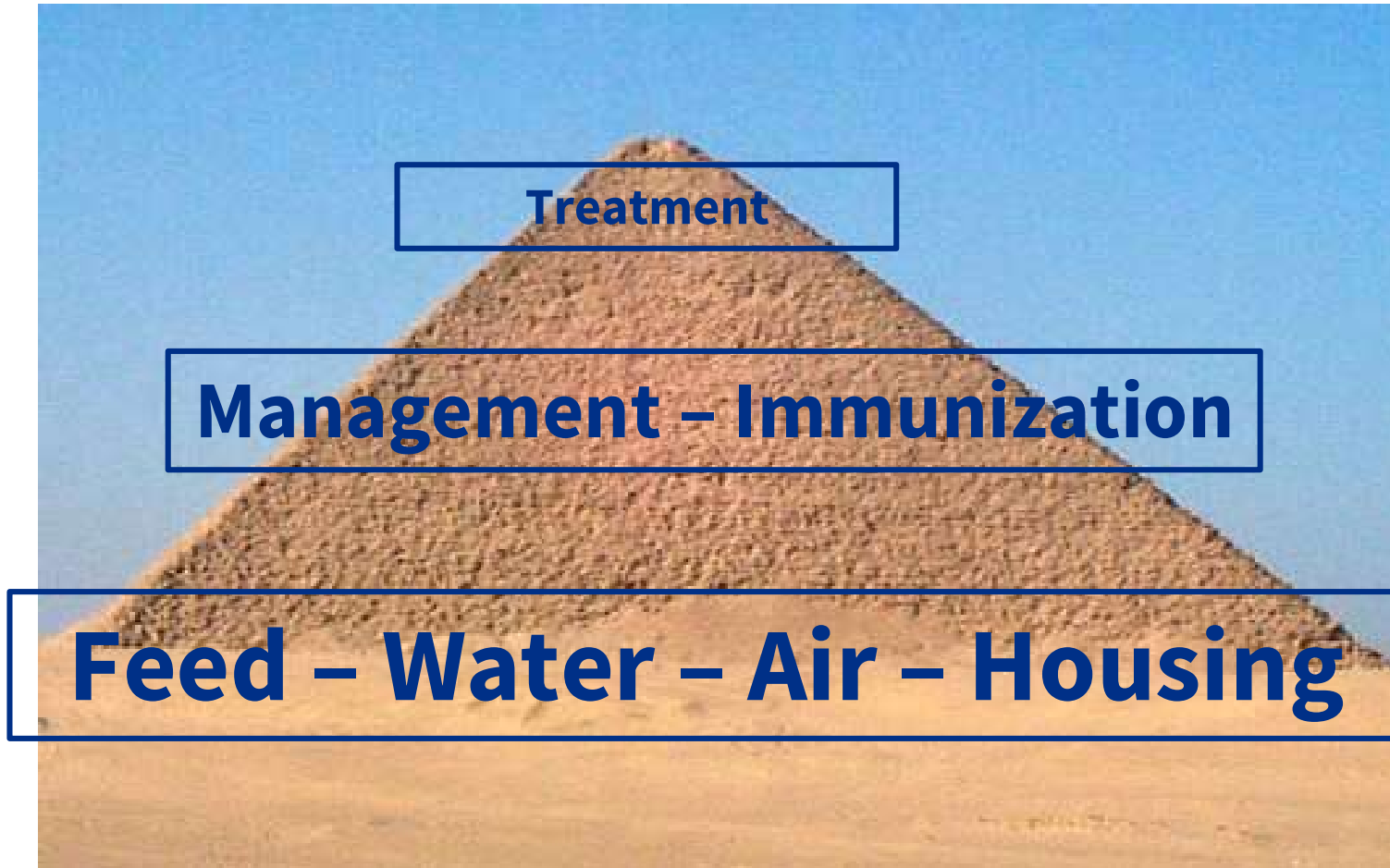
**Gut microbiota is very dynamic in piglets.**  
**High risk of overflow of pathogenic bacteria.**  
**Mainly controlled by both colostrum and sow milk.**  
**Sow milk protects during the entire lactation.**  
**Important influence of feed ingredients, especially fibers.**



- Everything starts with the sow



If we take care of the sow, then the sow will take care of the pigs



Good quality  
Plenty

Gestation 12-20 L/sow/day

Lactation 25-35 L/sow/day

Test of gravity in urine is a good way to be sure if the sow gets enough water

Hypotonic <1.010  
Isotonic 1,010 – 1,015  
Hypertonic 1,015>



Slaughterhouse examination is a very good way to investigate the consequence of lack of water





#	Animal type	#	Location	Serving week #	Urine SP G.	alb	pro	cre	ph
1	Gilt	15543	NGS	age 23w	1,01	1-3	—	100-200	5,0
2	Gilt	16659	NGS	age 14w	1,012	8-15	—	50-100	5,0
3	Gilt	16607	NGS	age 15w	1,008	1-3	—	10-50	5,0
4	Gilt	4308	NGS	age 18w	1,004	1-3	—	10,0	5,0
5	Gilt	15522	NGS	age 23w	1,012	3-8	—	200-300	5,0
6	Gilt	16299	NGS	age 16w	1,008	8-15	—	10,0	6,0
7	Gilt	16358	NGS	age 16w	1,008	1,0	—	10,0	6,0
8	Gilt	15510	NGS	age 23w	1,014	8-15	—	300,0	6,0
9	Gilt	4048	NGS	age 28w	1,01	8-15	—	200,0	6,5
10	Gilt	15542	NGS	age 23w	1,008	1,0	—	200,0	7,5
11	SOW	16623	LGSS	8	1.014	1,0	—	300,0	5,0
12	SOW	13587	LGSS	8	1.016	1,0	—	200,0	6,0
13	SOW	13437	LGSS	8	1.004	1,0	—	50,0	6,5
14	SOW	14517	LGSS	8	1.024	8-15	15+	300,0	5,0
15	SOW	15080	LGSS	8	1.014	1-3	—	100-200	5,0
16	SOW	Y3073	LGSS	8	1.040	15,0	15+	300,0	5,0
17	SOW	Y2870	LGSS	8	1.030	1,0	—	100-200	5,0
18	SOW	14811	LGSS	8	1.040	8-15	15+	300,0	5,0
19	SOW	16359	LGSS	8	1.010	8-15	—	100,0	5,0
20	SOW	Y2532	LGSS	8	1.020	8-15	30	300,0	5,0
21	SOW	11139	LGSS	8	1.020	15,0	30	300,0	5,0
22	SOW	15007	LGSS	8	1.040	8,0	—	300,0	5,0

#	Animal type	#	Location	Urine SP G.	alb	pro	cre	ph
1	SOW	34770	LGSS	1.012	1-3	—	300,0	5,0
2	SOW	16342	LGSS	1.014	1-3	—	300,0	5,0
3	GILT	19658	LGSS	1.006	1-3	—	300,0	5,0
4	SOW	14880	LGSS	1.012	1-3	—	300,0	6,5
5	SOW	Y2812	LGSS	1.024	8-15	15	300,0	6,5
6	GILT	37620	LGSS	1.030	1-3	—	300,0	5,0
7	GILT	19802	LGSS	1.036	1-3	—	300,0	5,0
8	GILT	Y50407	LGSS	1.012	1-3	—	300,0	5,0
9	GILT	37630	LGSS	1.032	8-15	—	300,0	5,0
10	SOW	15717	LGSS	1.012	1-3	—	200,0	6,5
11	GILT	19822	LGSS	1.028	1-3	—	300,0	5,0
12	SOW	14711	LGSS	1.010	1-3	—	300,0	5,0
13	SOW	17849	LGSS	1.022	1-3	—	300,0	6,0
14	SOW	14662	LGSS	1.020	1-3	—	300,0	6,0
15	SOW	15032	LGSS	1.014	1-3	—	200,0	6,0
16	SOW	14653	LGSS	1.012	1-3	—	200,0	6,5
17	SOW	35727	LGSS	1.010	1-3	—	300,0	6,0

## Air

### Comfort temperature

Sows 15-20 °C

Piglets 28-32 °C

### Minimum ventilation

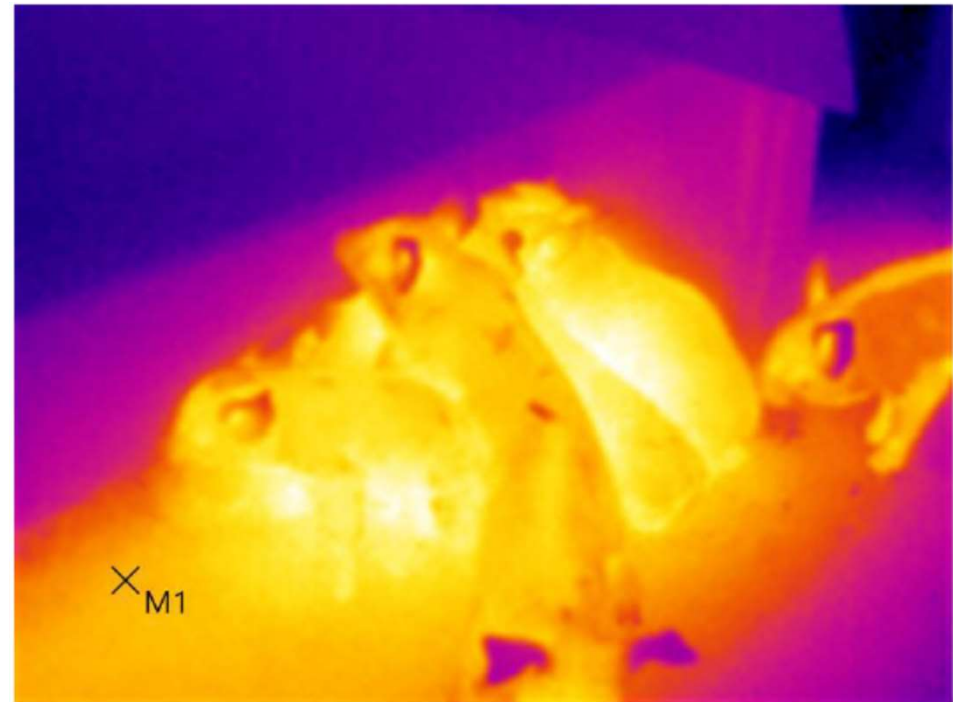
30 m<sup>3</sup> per hour per sow

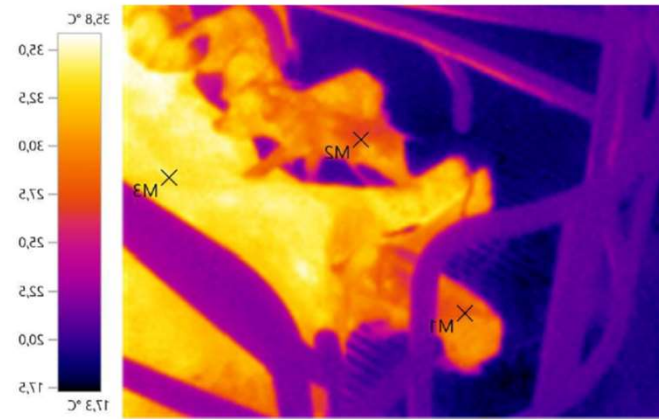
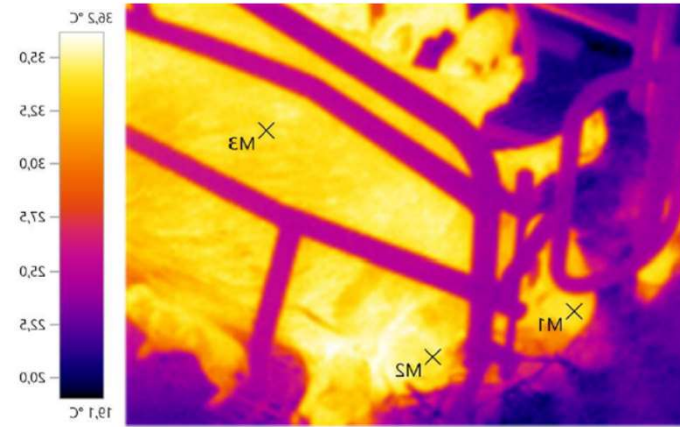
Too high temperature for sows results in reduced appetite, difficult farrowing and lack of milk

Too low temperature for piglets results in waste of energy, reduced activity and increased risk of infections

Too low airflow increases risk of pulmonary infections, but draft results in cooling of the pigs







## **Piglets:**

To feed as early as possible with lots of fibers is essential to promote probiotic lactobacilli.

Milk replacer can support the sow and provide the pig with energy but does not help against infections.

Many feedings per day are important.

Begin to feed piglets day 4 with small amount of food. Increase gradually.

The goal is that pigs should eat 600 grams of food before weaning

Feed should not be too easy to digest. The pigs are protected by the

SOWS.

## Sows:

Main nutrients for milk production are:

Lysine

Glucose

Diet must be rich in protein.

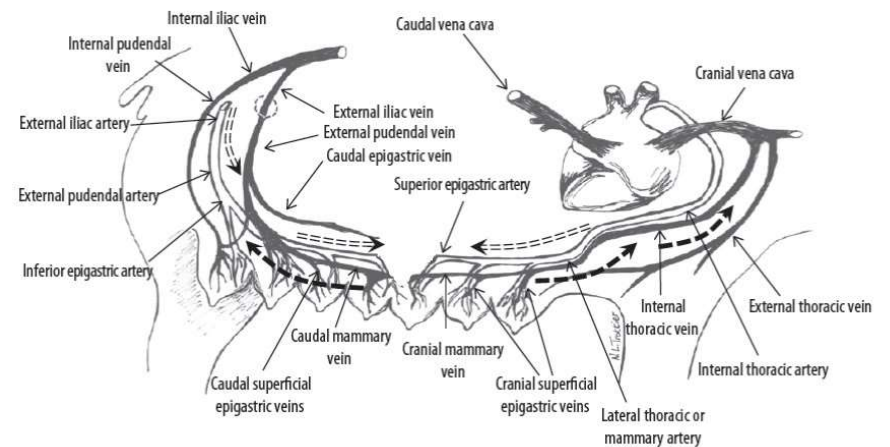
Main nutrient for farrowing is

Glucose

Diet must be rich in carbohydrates and fibers

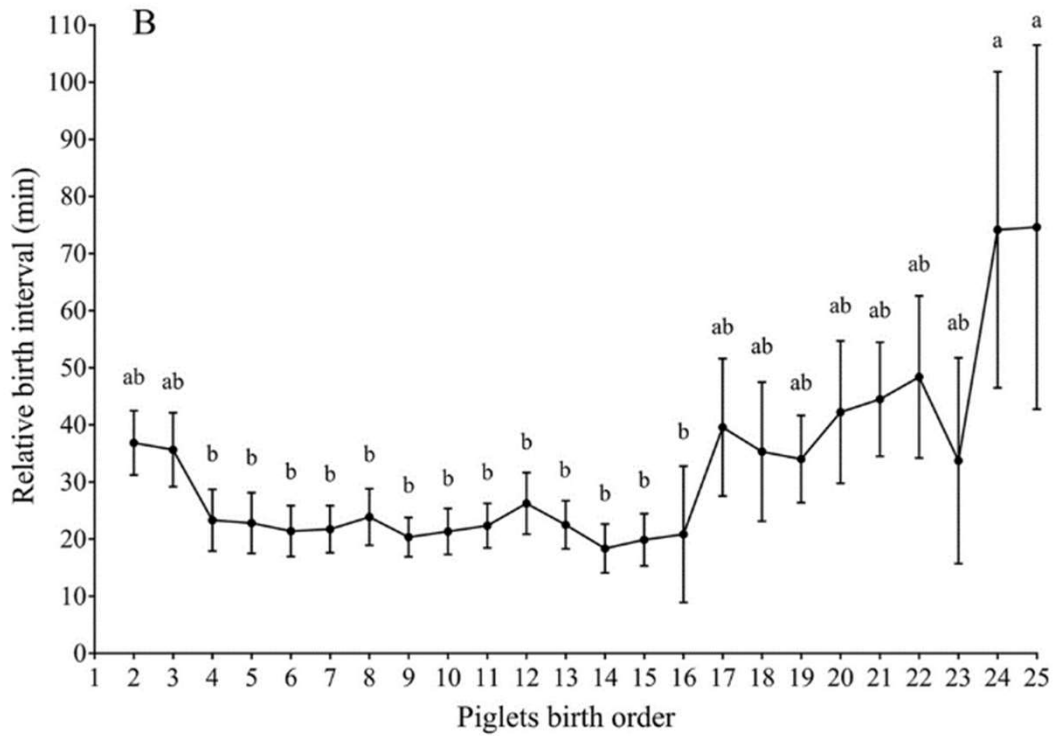
Low quality protein like soya  
increased risk of diarrhea  
High quality protein like fishmeal  
increased milking without risk

Protein is needed for  
milking but not for  
farrowing.



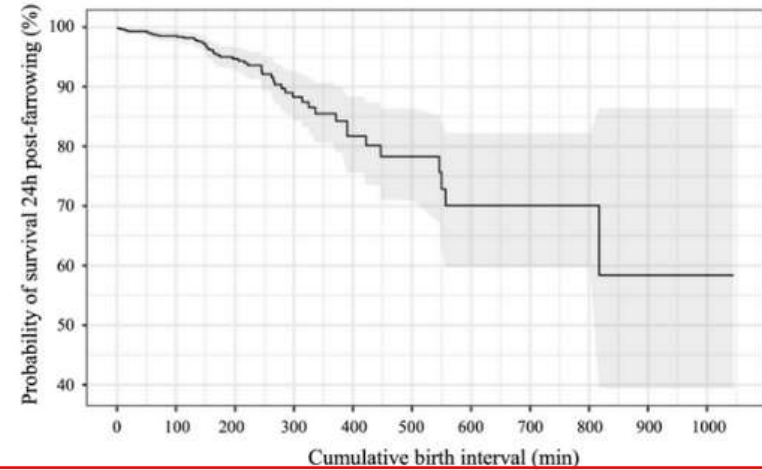
Modified from C. Farmer: The lactating and gestating sow 2015

Birth order classification



interval was associated positively with piglet mortality 24h post-farrowing. Furthermore, only colostrum intake was found as a significant ( $p < 0.01$ ) variable associated with piglet mortality from 24h post-farrowing until weaning (Table 9).

**Fig. 3**



Probability of piglets being alive until 24h post-farrowing according to their respective cumulative birth interval. 983 piglets were included in this analysis. Stillborn and mummified piglets were not included

## Vaccination against Neonatal diarrhea in Denmark

E. Coli 100%

Clostridium perfringens type C 100% (Because it is in the Coli vaccines)

Clostridium perfringens type A 90% It has been a real gamechanger

Cl. difficile around 30%

Rotavirus 10%

## Vaccination program

### Gilts:

*Standard*

2 times before first farrowing

*Strong*

2 times just around insemination

1 time before farrowing

### Sows:

*Standard*

1 time before farrowing

*For the brave*

Nothing

## Feed back

Very good tool to control diarrhea  
Provides immunization against all potential pathogens in the herd  
Short lasting effect.

## Procedure:

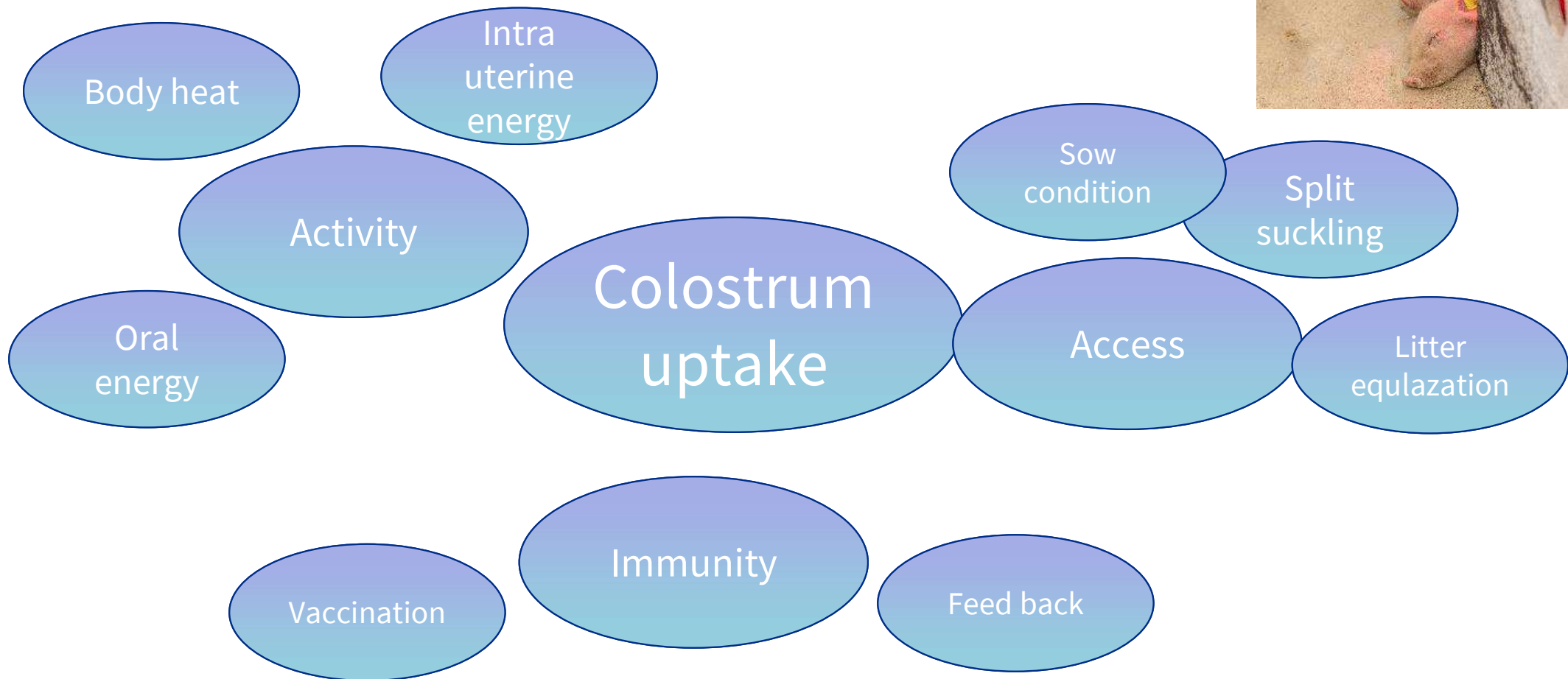
Collect diarrhea clots with paper towel 2-3 times per week  
Dissolve towels in water  
Add a bit of tasty feed  
Distribute to gilts 3 and 6 weeks before farrowing.

## Mistakes:

Don't give it to sows – It is not necessary  
Don't let it stay in growing media – all viruses will be killed and only commensal bacteria will survive.



Day 1 – The most important day in a pig's life



Sows must have plenty of food up to farrowing

Rich in carbohydrates and fibers

3.5 kg every day. Let the sow decide!

Feedings must be evenly distributed

Pigs must be kept warm

Drying as fast as possible

Functional heating plates /Corners

Small pigs must have oral energy 4-5 times

Sugar/Syrup

Commercial products

Split suckling

Always leave one pig per teat outside

Maximum 30 mins isolated

Only isolate big pigs

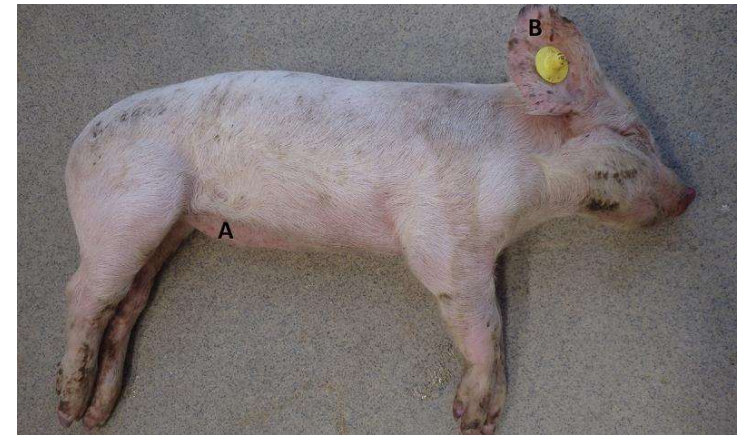
12 hours minimum from end of farrowing, but longer is better



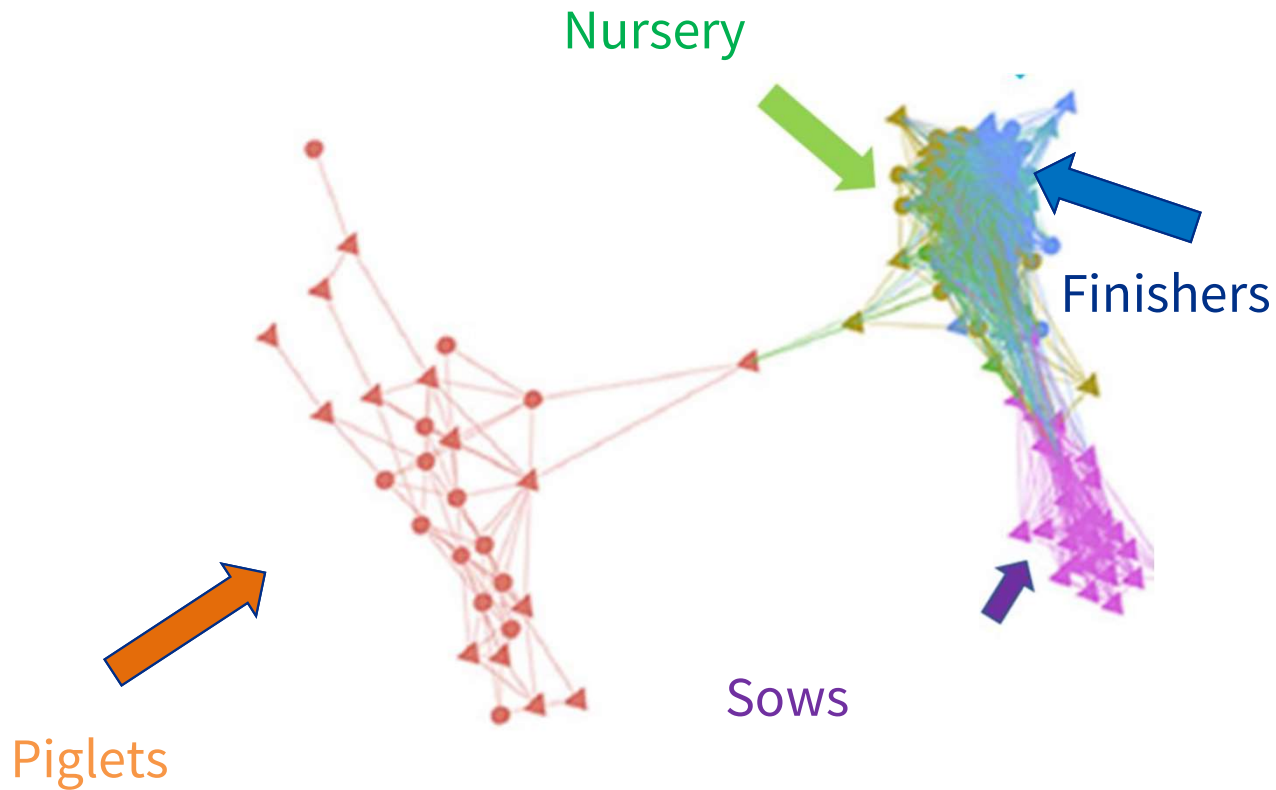
# Post-Weaning Intestinal infections

## Introduction

- Probably 80% of antibiotic usage in DK
- Caused by E. coli and a very wide range of bacteria and virus
- Severity from mild infections to disastrous outbreaks
- Increased number of cases in 2023 following ban of Zinc oxide in Europe



From Seges



When the pigs go from milk diet to solid food the change in microbiota is dramatic.

After weaning the pig is no longer protected by the lactogenic immunity

Mach et al., 2015

- Feed is essential to control PWD
  - At weaning the pig must be ready to digest food
    - Enzymes
    - Intestinal villi
    - Microbiota
  - Over the lactation period each pig should have eaten around 600 grams of feed with a very differentiated composition
- Access to feed
  - Pigs are social eaters. Plenty of space for eating is necessary
  - Pigs are not born to handle a feeder. Food must be easily accessible
- Fibers
  - Feed the probiotic bacteria
    - Barley, oats, sugar beet pellets



## In farrow stable:

Start day 4 and increase gradually

Small amounts several times per day

Turn off any milk system at least 7 days prior to weaning

As rich in fibers as possible.

## For veterinarians:

Use dead pigs as control

Note the amount of real food.

Observe!



# Recommendations about protein

3 step feeding

Step 1 – Safe. **Establish a good intestinal function. 1-3 weeks**

- Maximum 140 mg digestible protein per kg
- But 11-11.5mg digestible lysine per kg
- High quality protein – Fish meal, blood plasma
- Synthetic amino acids

Step 2 – **Training** to reach step 3. **1-2 weeks**

- 12 mg digestible lysine. Max 150 g digestible protein per kg
- More soya
- Still some high-quality protein

Step 3 – **Power growth.**

- 12.5 -13 mg digestible lysine
- Max 160 mg digestible protein



## Focus of water is essential to control PWD

- Pigs like a water surface
- Many don't know how to use a nipple
- They must drink in order to eat dry food.
  
- Water systems must be cleaned between batches.
  - CID 2000 or similar is a good choice
  - Especially important if antibiotics are given via water



All in – all out procedures

Wash and disinfection are of course necessary

- Soaking

- High pressure washing

- Soap

- Final wash

Drying out is more important

- Concrete floor must be the same temperature as the room

Heating

- 24°C on day 1 in resting area

- Floor heating if possible



- Use separate boots
- Fast reaction and treatment of sick pigs
  - Prophylactic treatment is never beneficial
  - Collection of pigs falling behind
- Control of water and feed supply
  - Change of food according to age and size
- Control of climate
  - Air quality
  - Pigs resting behavior



# HIPRA

Building Immunity  
for a Healthier World