



Faculty of Health and Medical Sciences

Den robuste gris

....i en fremtid uden
antibiotika og ZnO

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Preterm Pig Intensive Care Unit

- to help answer difficult questions!



Why?

Controlled conditions
Multiple interventions
Detailed organ insights
Exploratory treatments
Ethics, economics, time
Translational relevance?

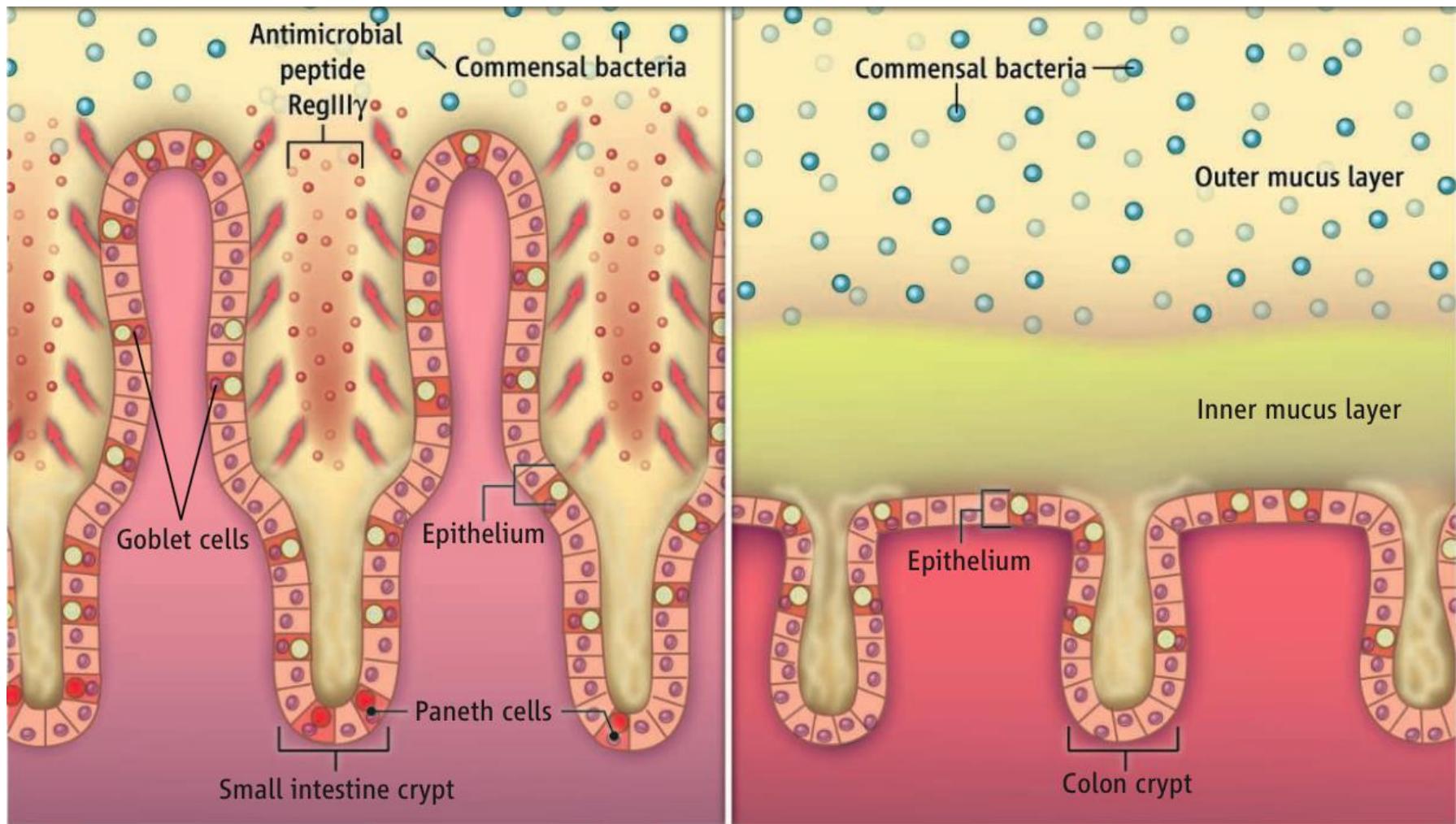
25 incubators

Respiratory support
Temp./moisture control
Low microbe (germfree)
Ventilated, high-moisture
Parenteral/enteral nutrition
24 hour camera surveillance

Seks ønsker for den robuste tarm omkring fravænning

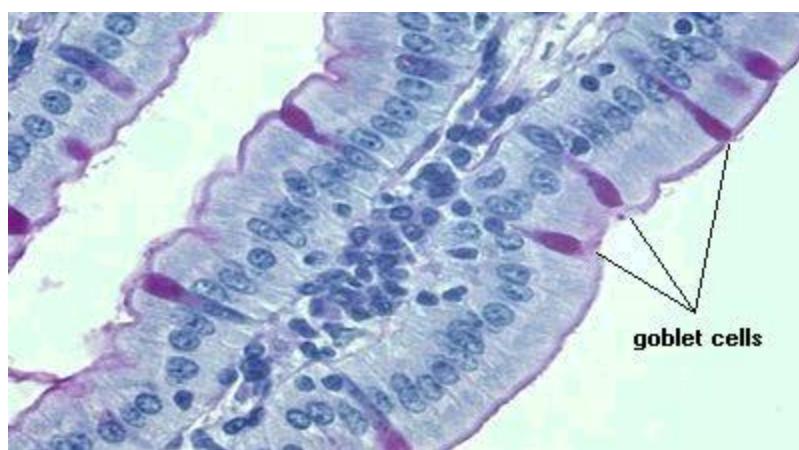
- Tykt beskyttende mucinlag
- Normal tarm-peristaltik
- Høj maltase, lipase, amylase, trypsin, aminopep. ect.
- Normalt enterohepatisk kredsløb af galdesalte
- Lavgradig leukocyt-infiltration i vævet
- Lav mikrobiel aktivitet



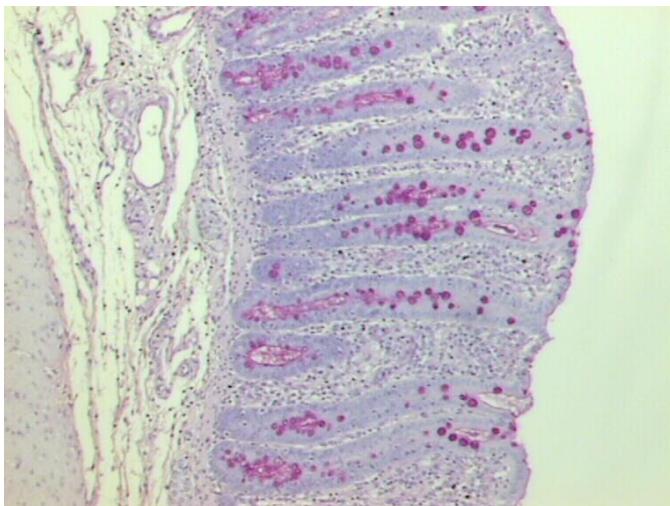


Modified from (Johansson & Hansson, 2011)

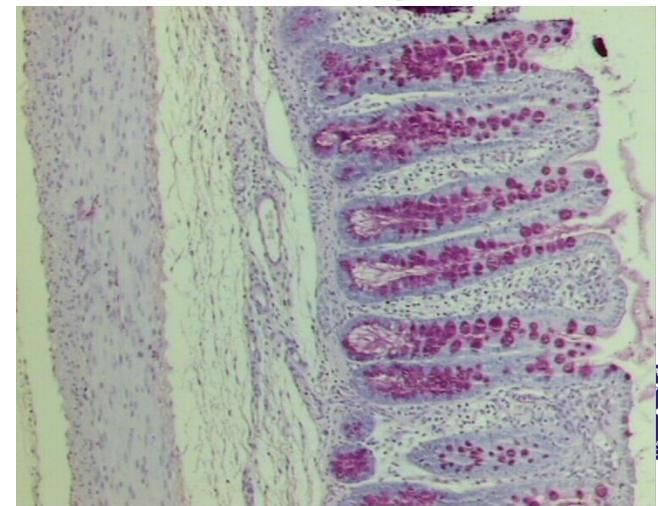
Mucin: den første skanse



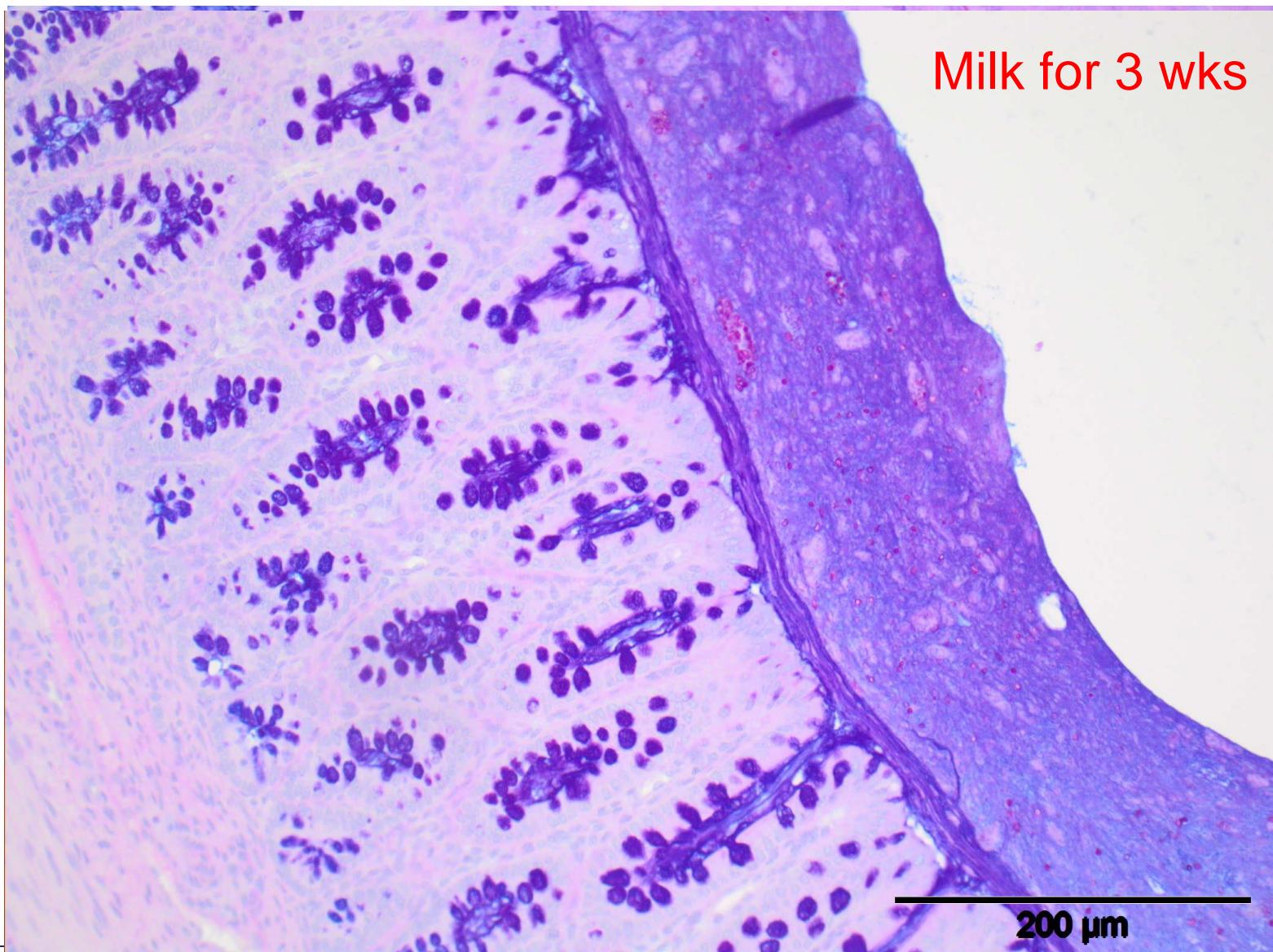
Kontrol



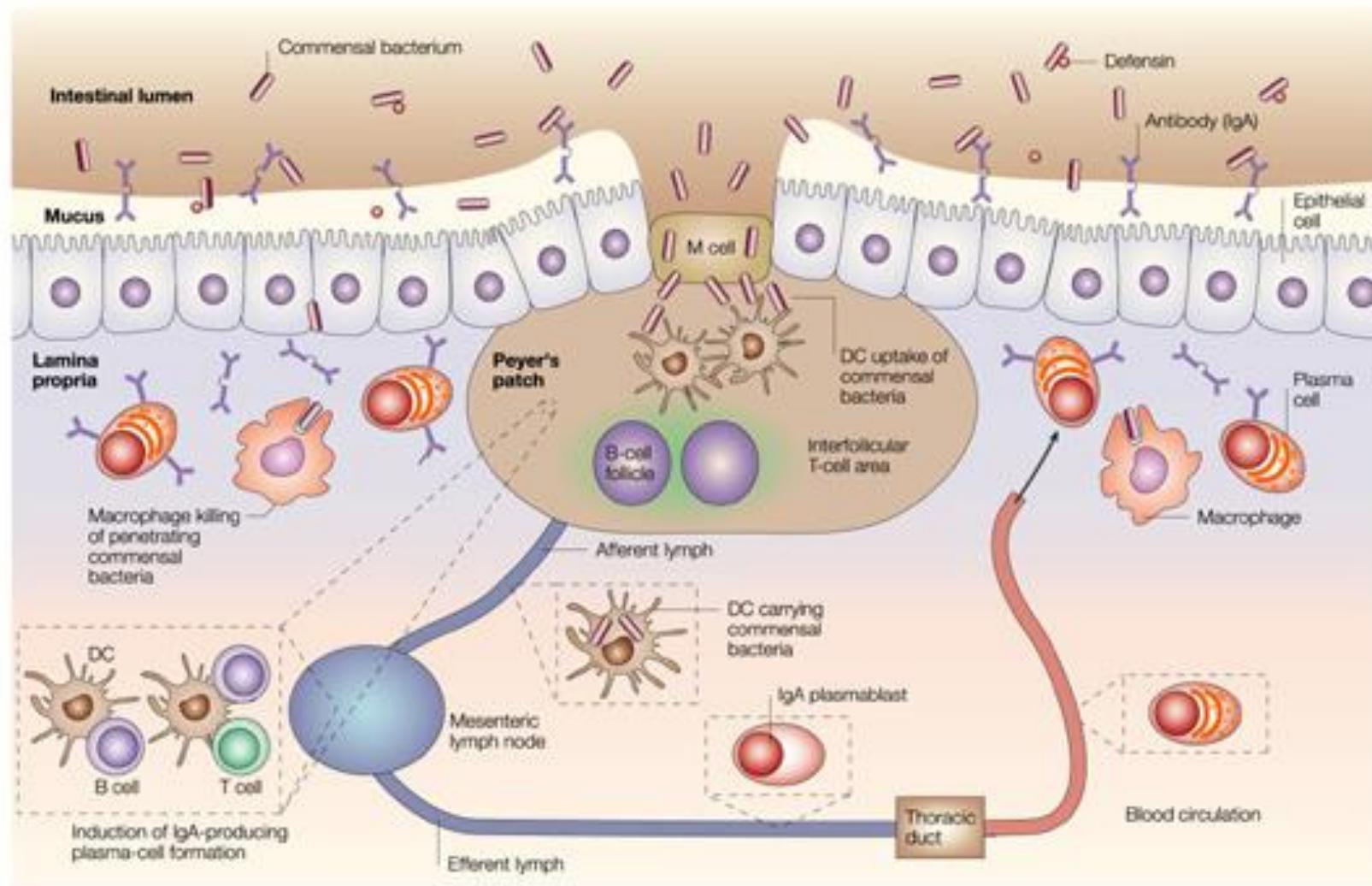
Anti



Colon double mucus layer in preterm pigs:



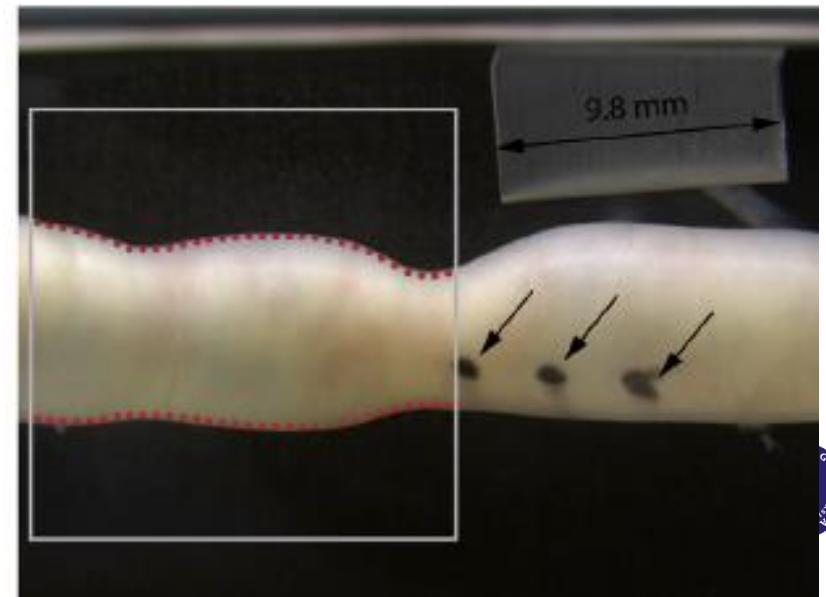
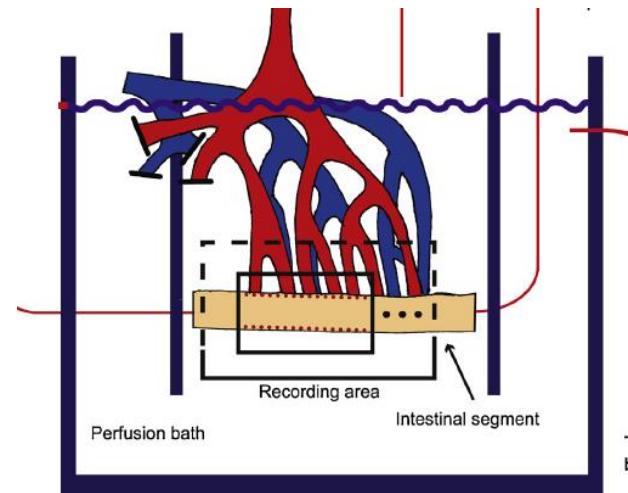
Development of adaptive (cellular and humoral) immunity



Quantifying peristalsis of the small intestine

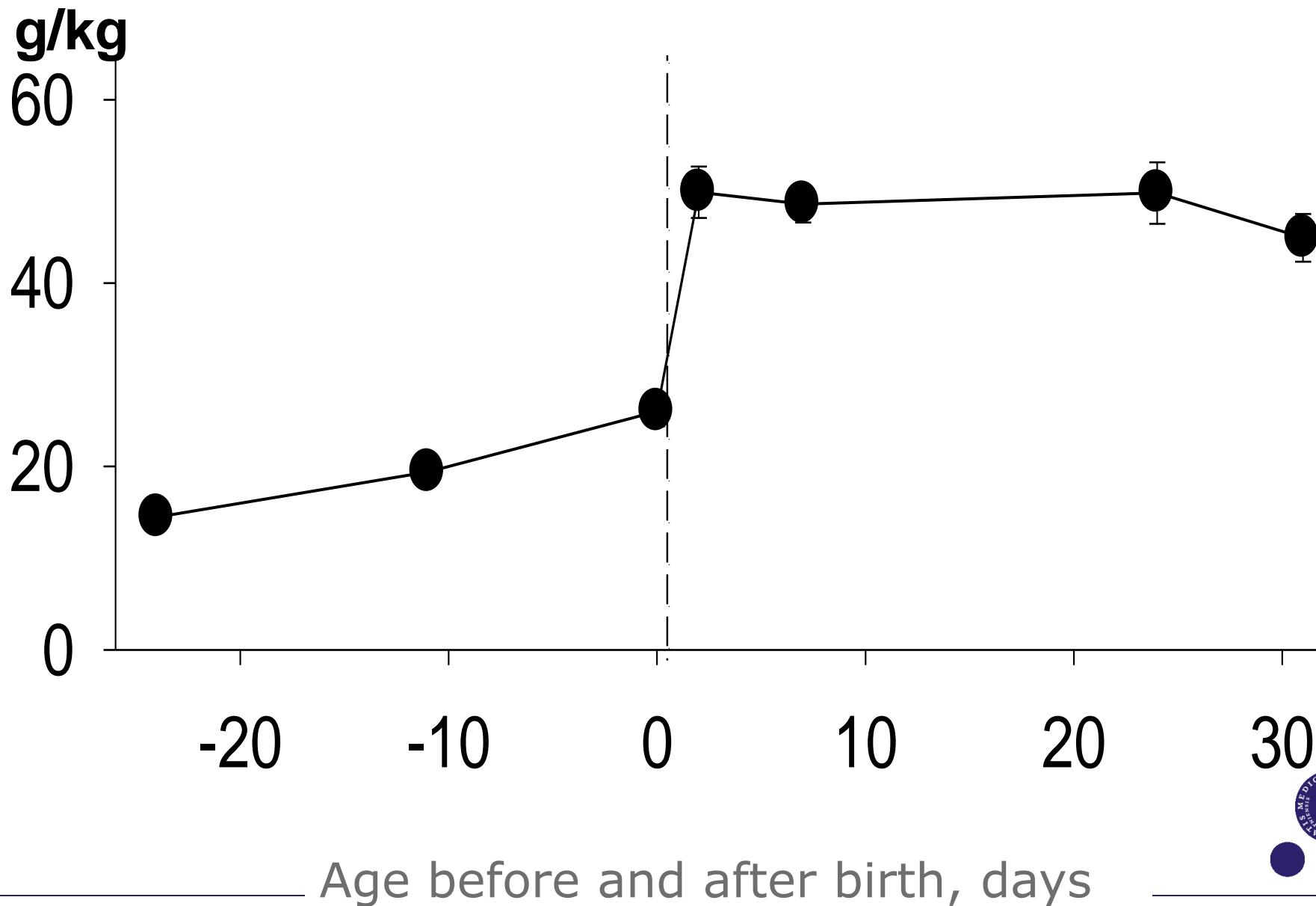
Ex vivo setup to quantify gut motility in action

Endpoints: contraction frequency,
contraction amplitude and contraction
pattern.



Weight of the small intestine relative to body weight

(Am. J. Physiol. 281, 2001)



Lærke & Hedemann; Reprinted with permission from John Wiley & Sons Ltd.

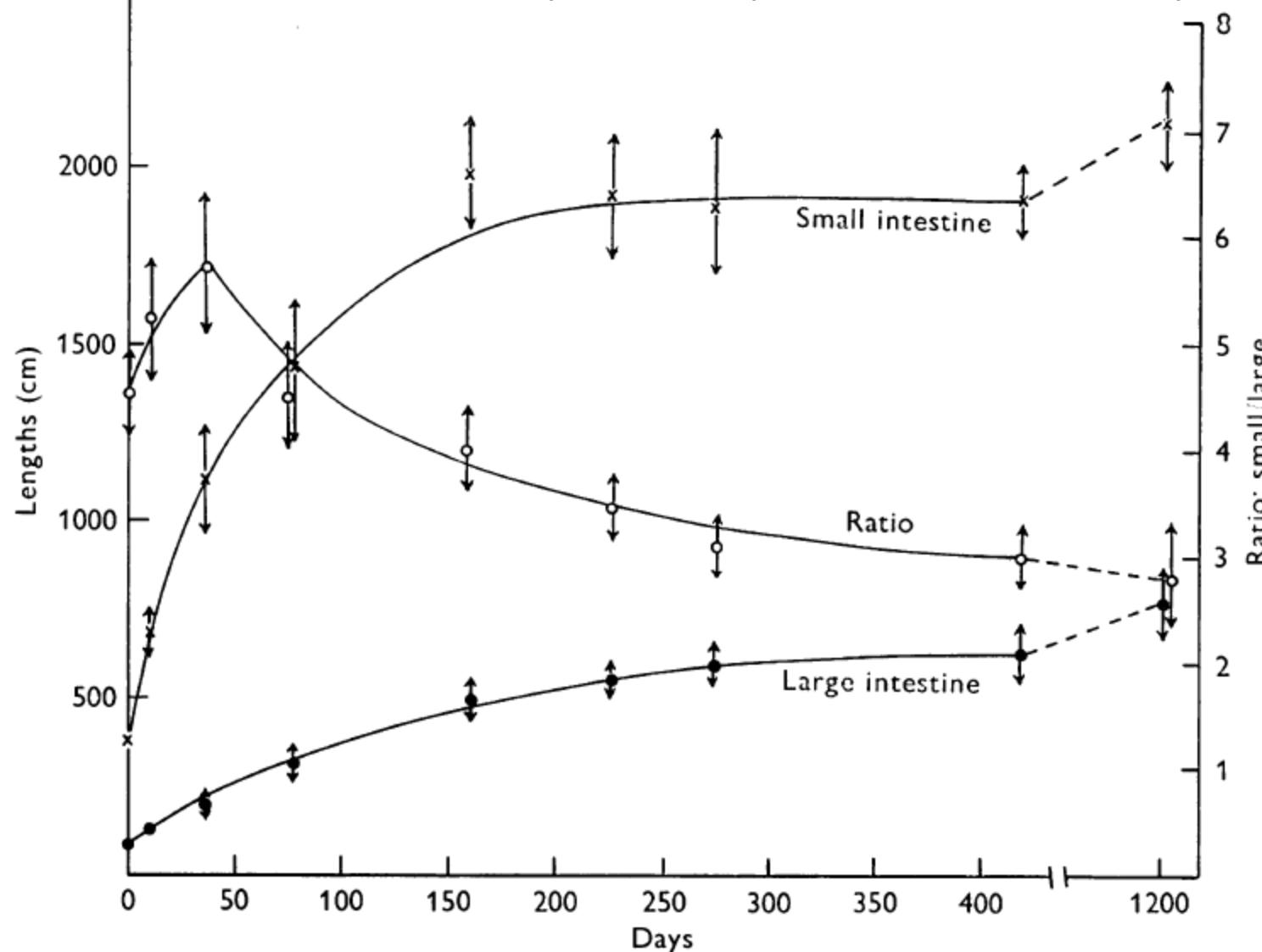
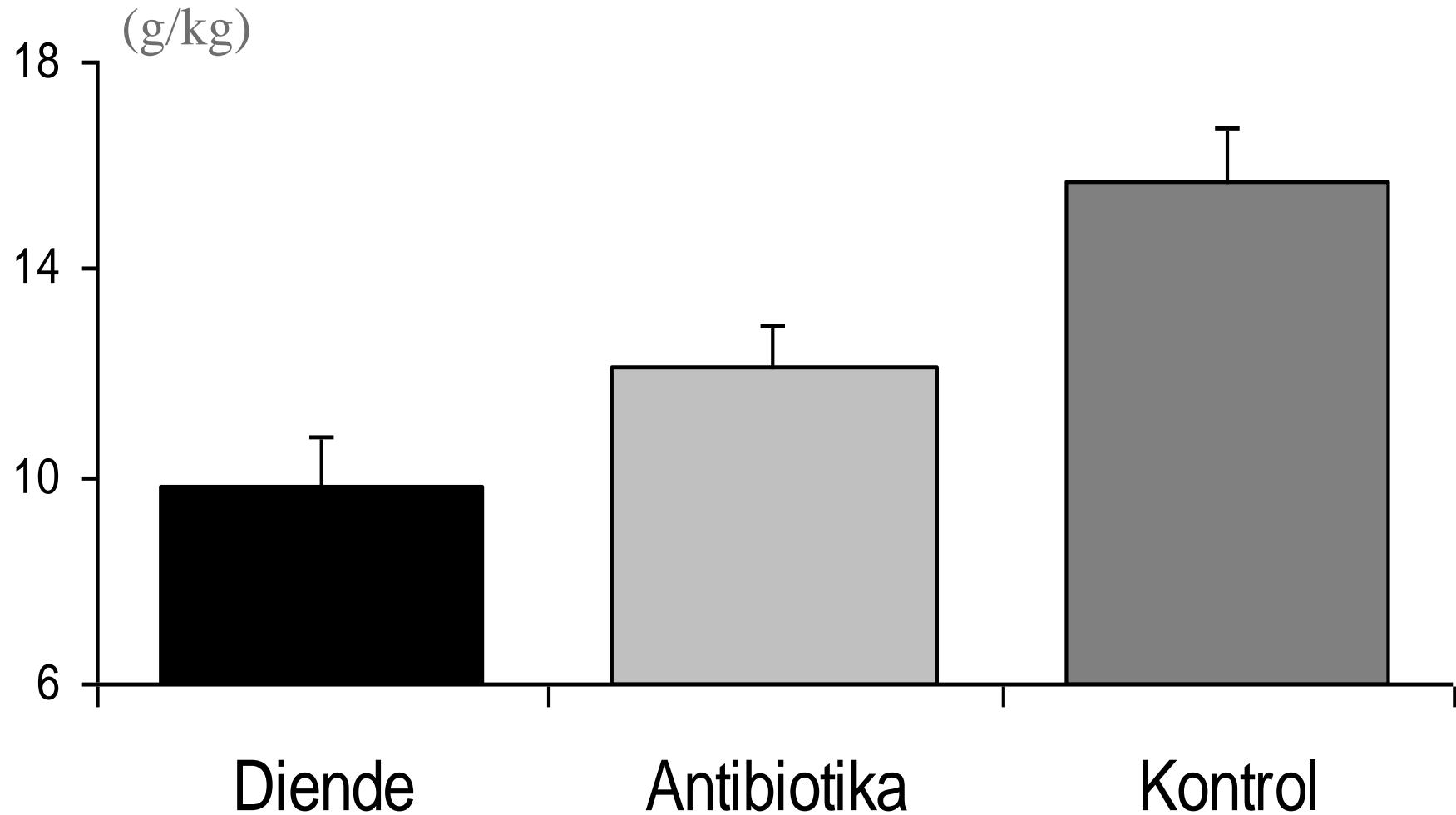


Fig. 1. The effect of age on the lengths of the small and large intestines and upon the ratio between them. $\times - \times$, small intestine; $\circ - \circ$, ratio; $\bullet - \bullet$, large intestine.

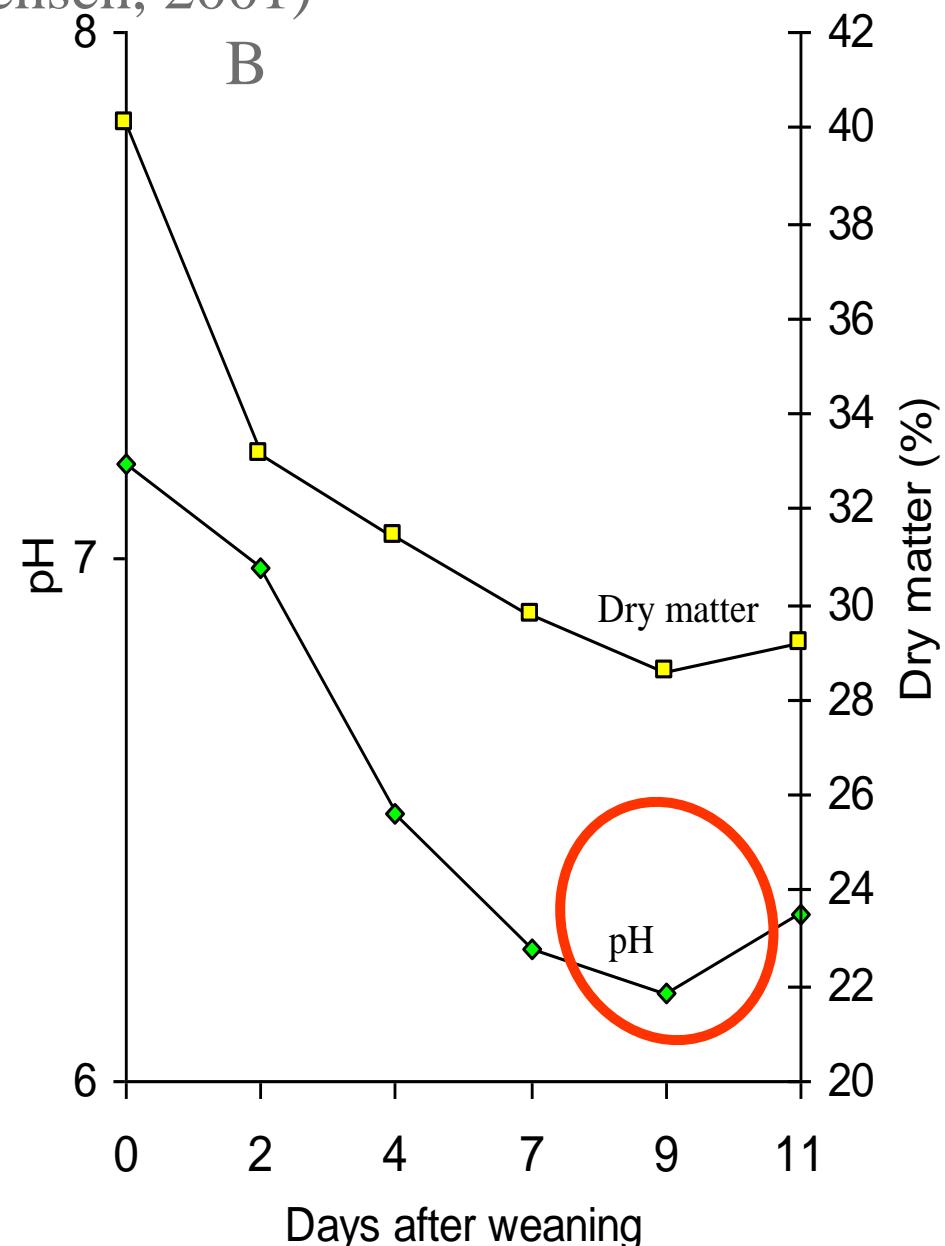
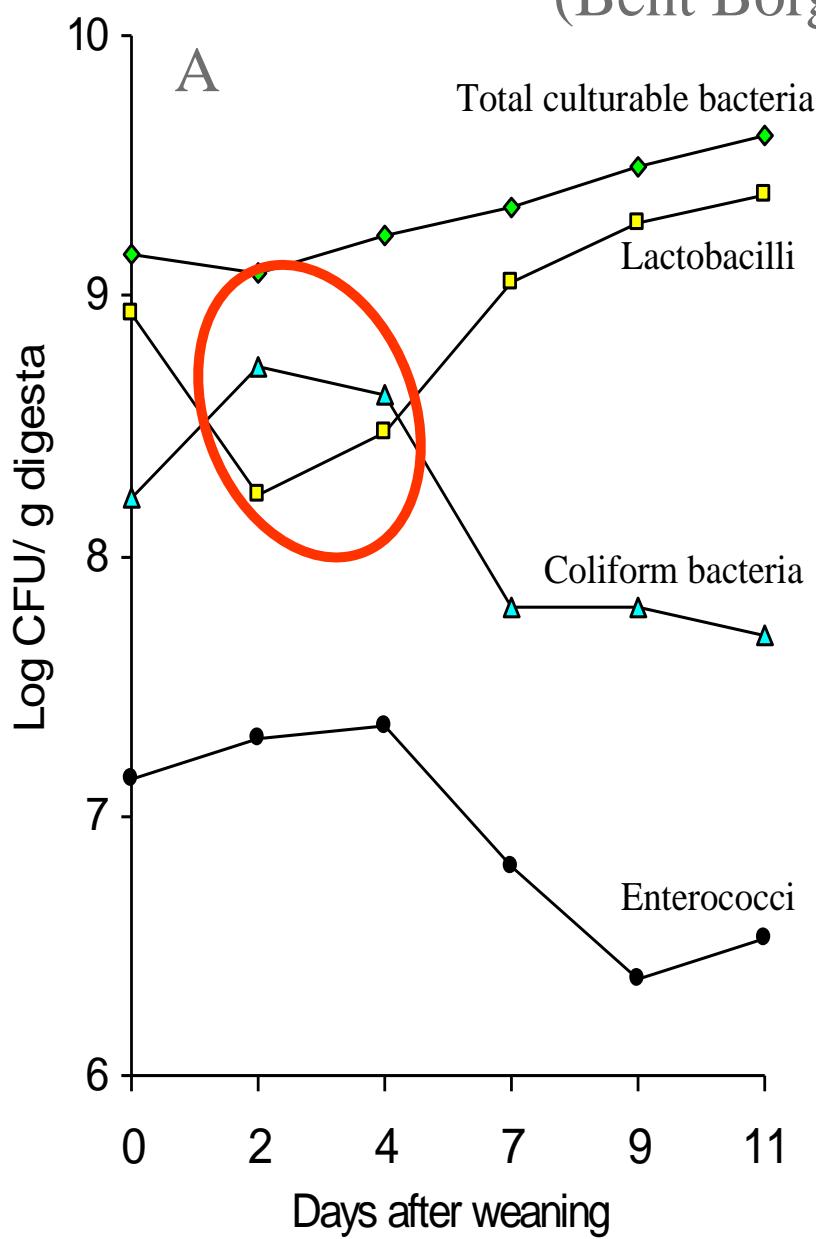


Postweaning growth of the colon

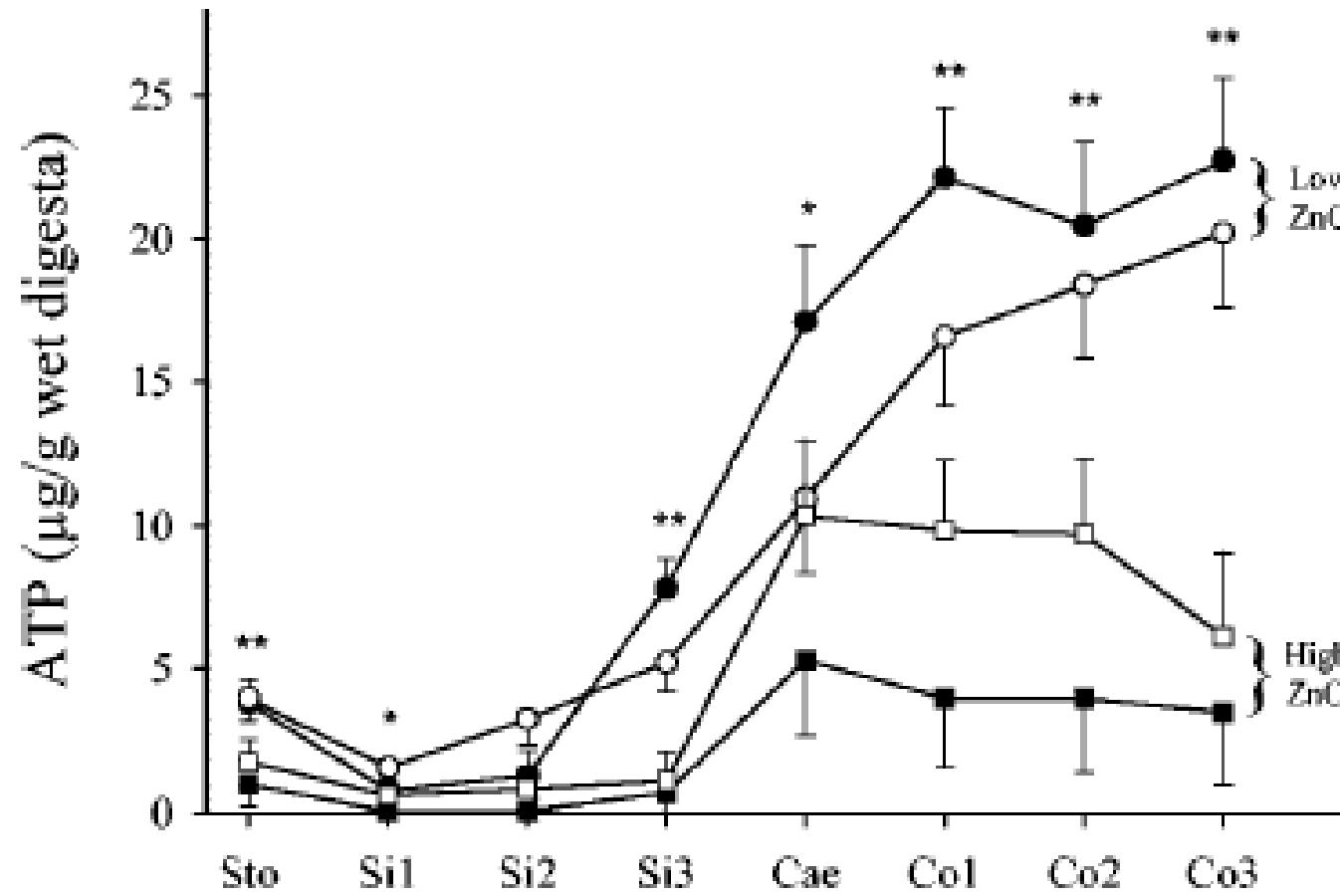


pH and bacteria post weaning:

(Bent Borg Jensen, 2001)



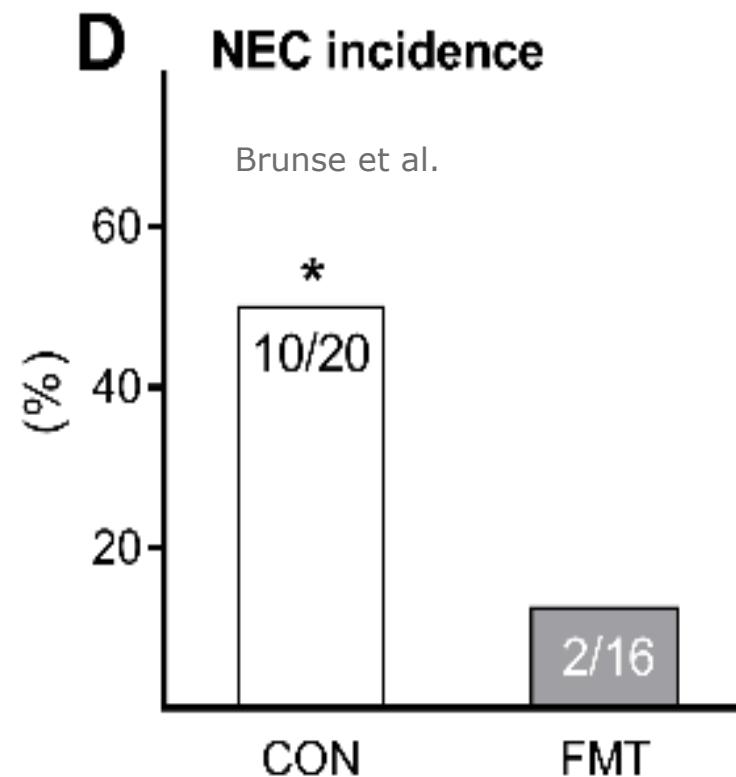
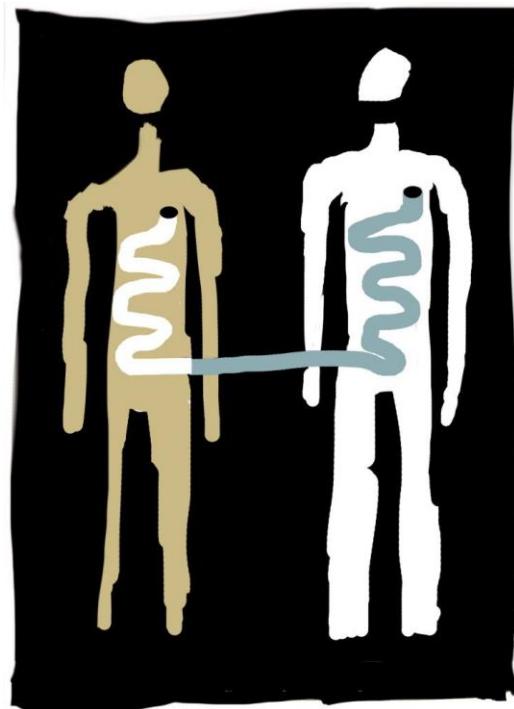
How does ZnO influence microbial activity in different sections of the GIT ?



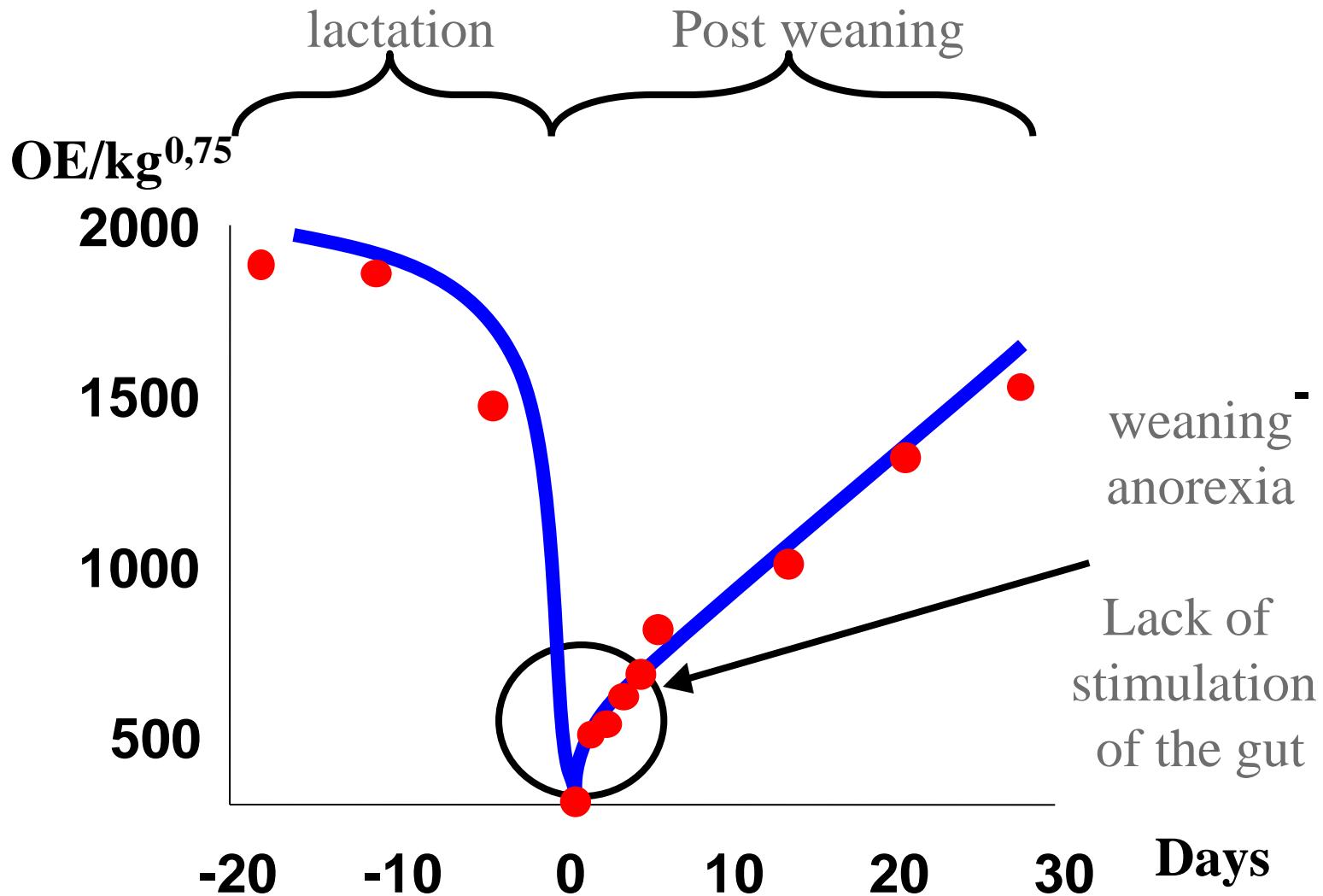
Højbjerg et al. APP AND ENVIRON MICROBIOL, 2005, p. 2267-2277

Sted og dato
Slide 14





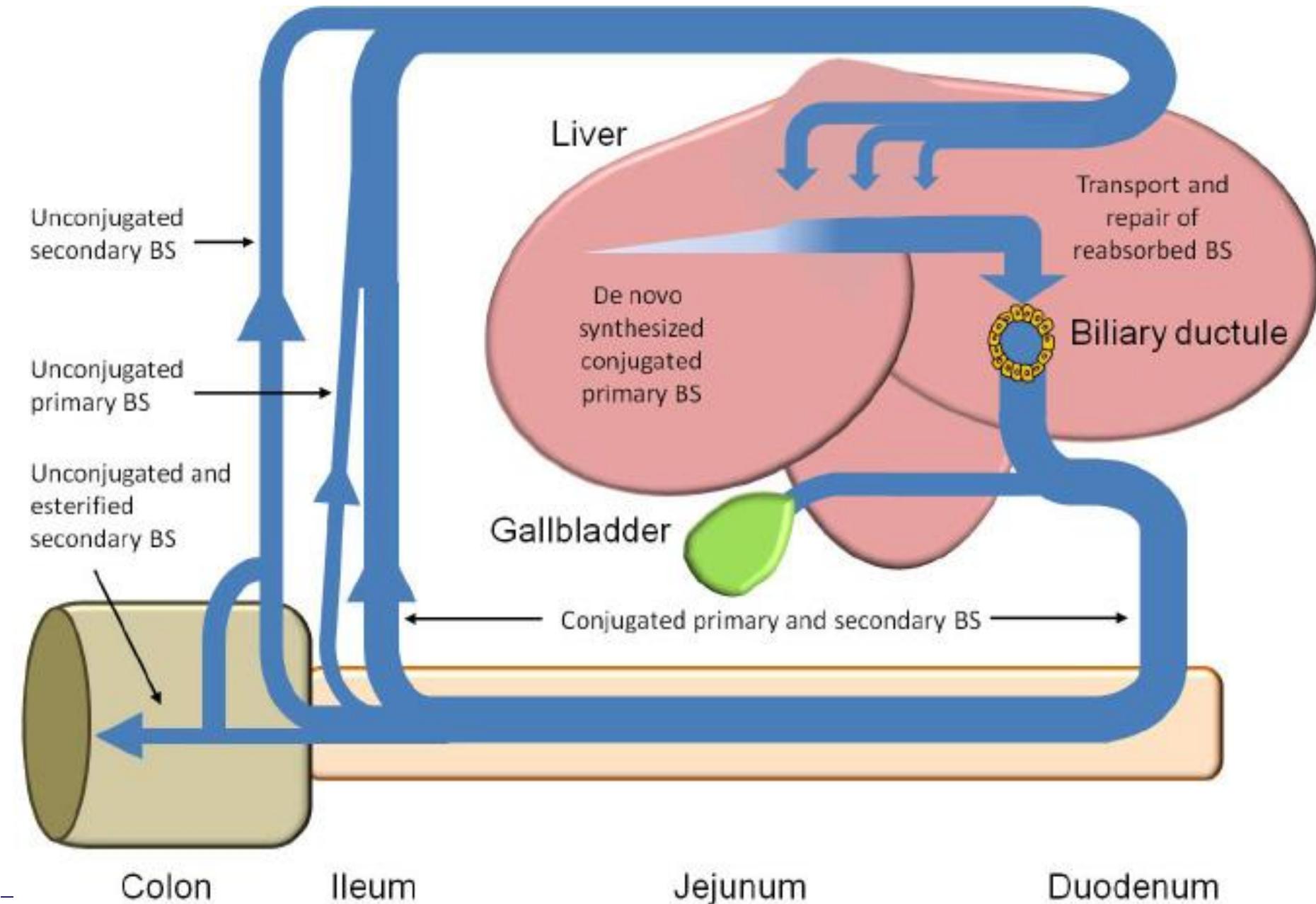
Fecal microbial transplantation from 10 day old healthy pigs to newborn recipients.
Marked protective effect !



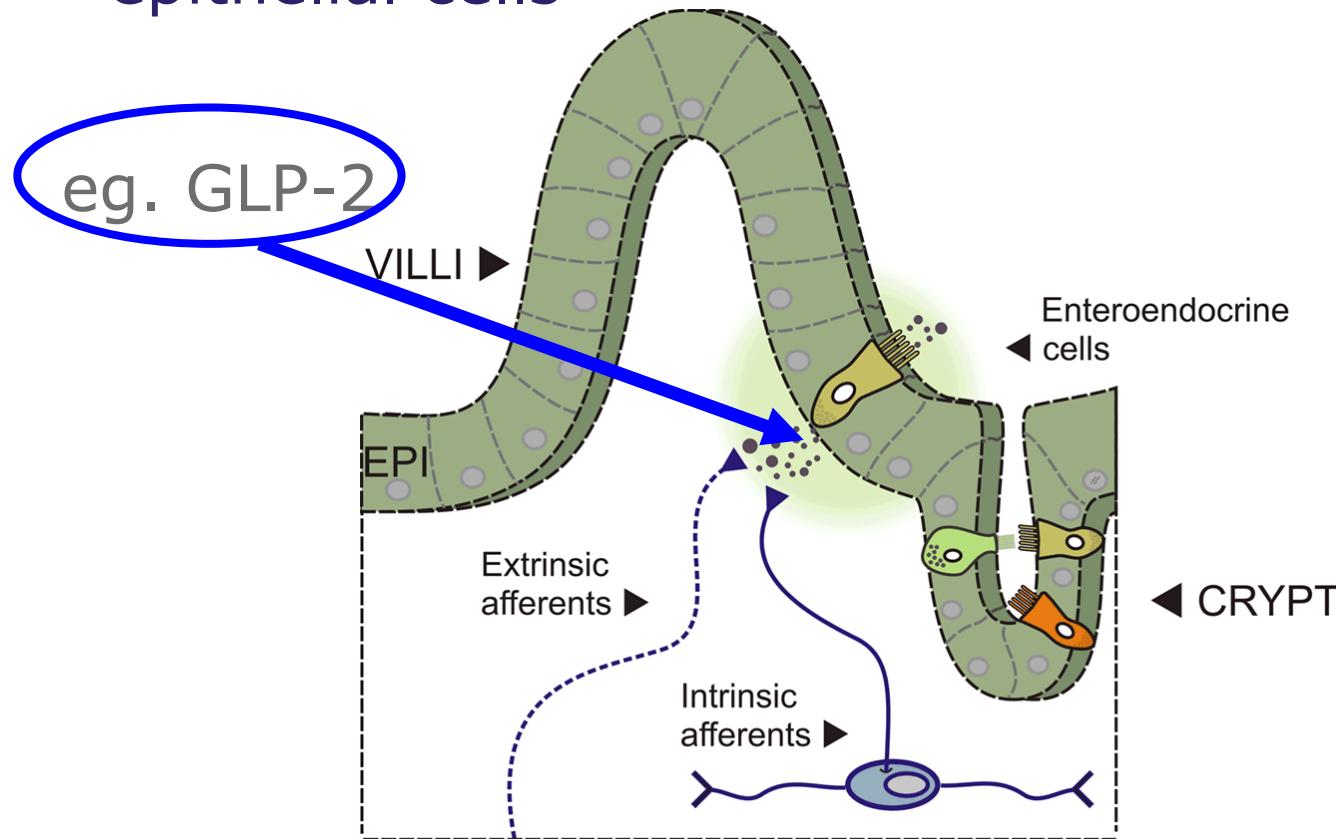
mod. e. Pluske 1993



Lærke & Hedemann, the digestive system of the pig

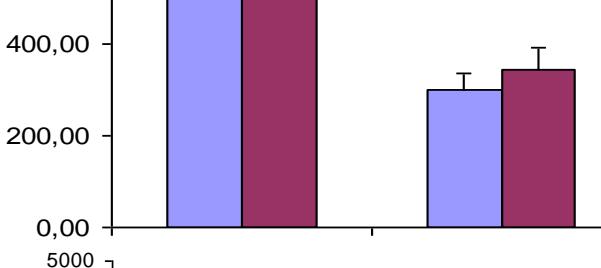


Intestinal chemosensing of luminal nutrients via enteroendocrine epithelial cells

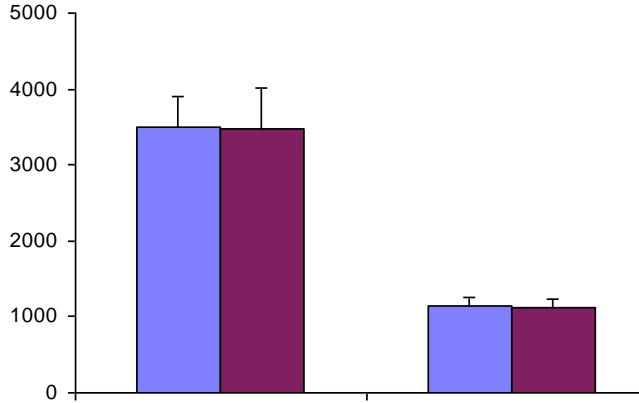


Bertrand 2009

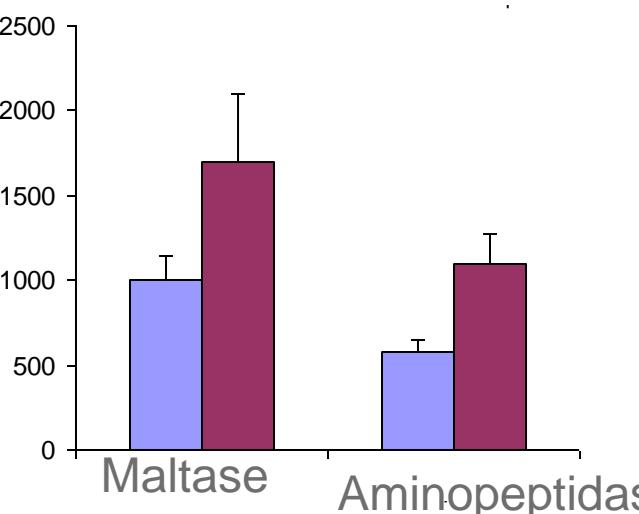




High sanitary conditions
Native GLP-2



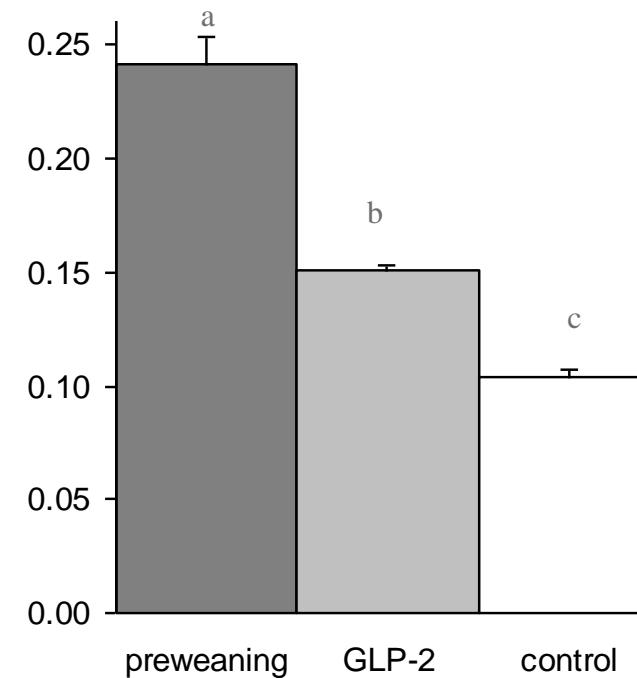
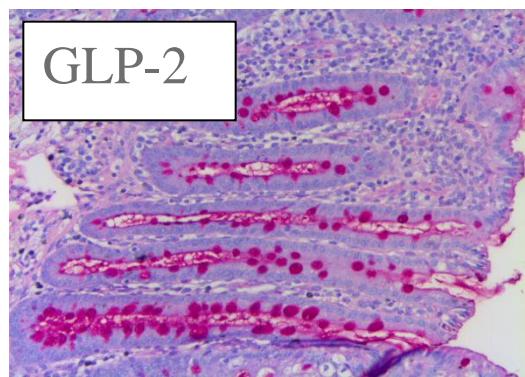
Low sanitary conditions
Native GLP-2



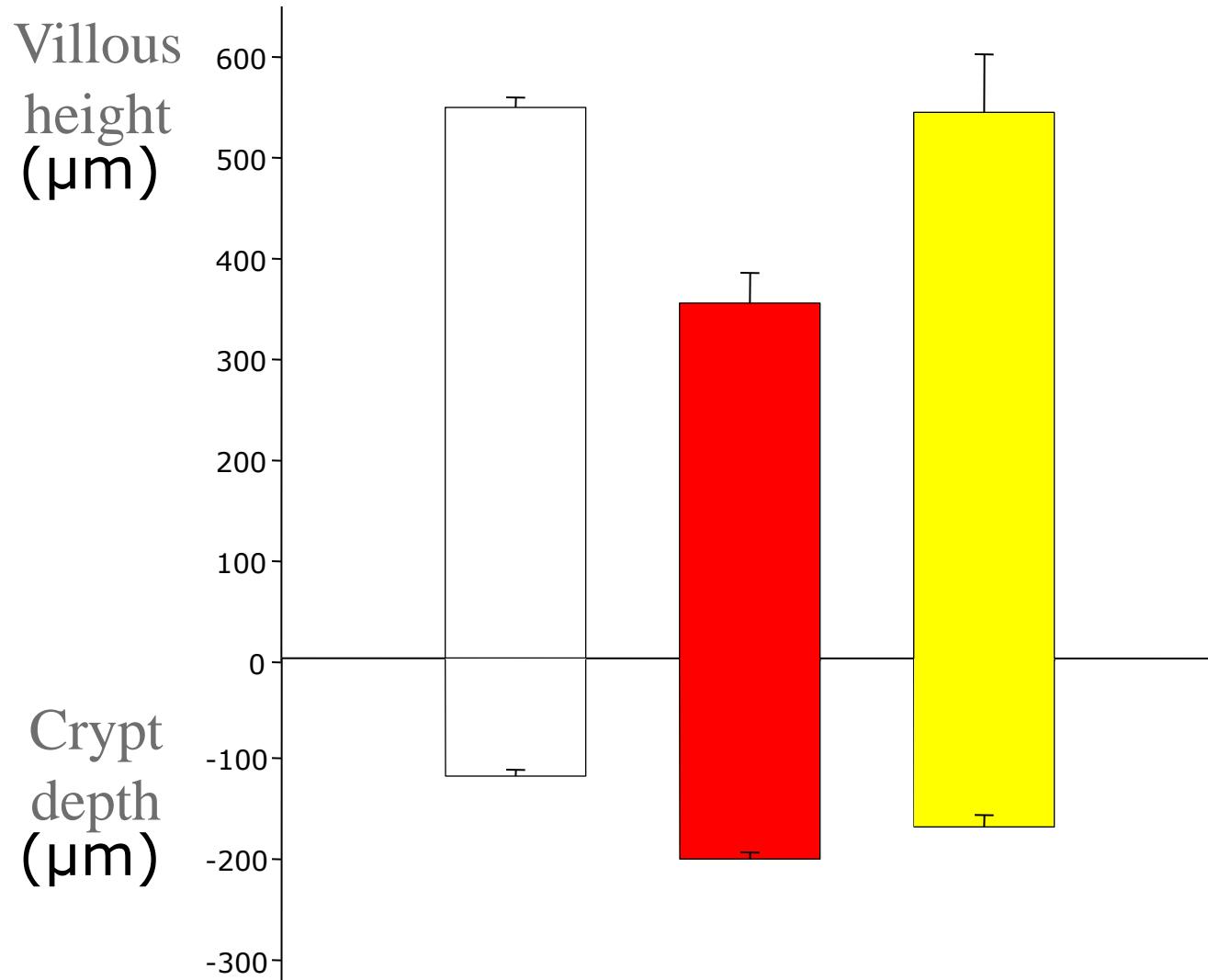
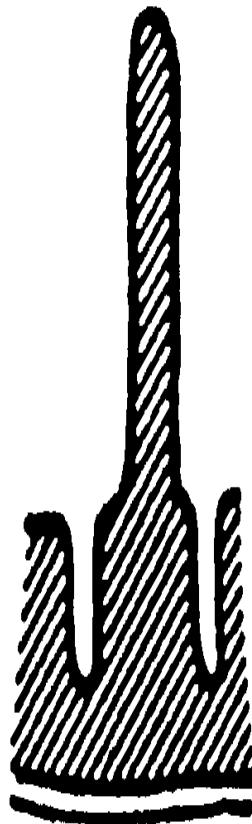
High sanitary conditions
GLP-2 analouge with
extended half life



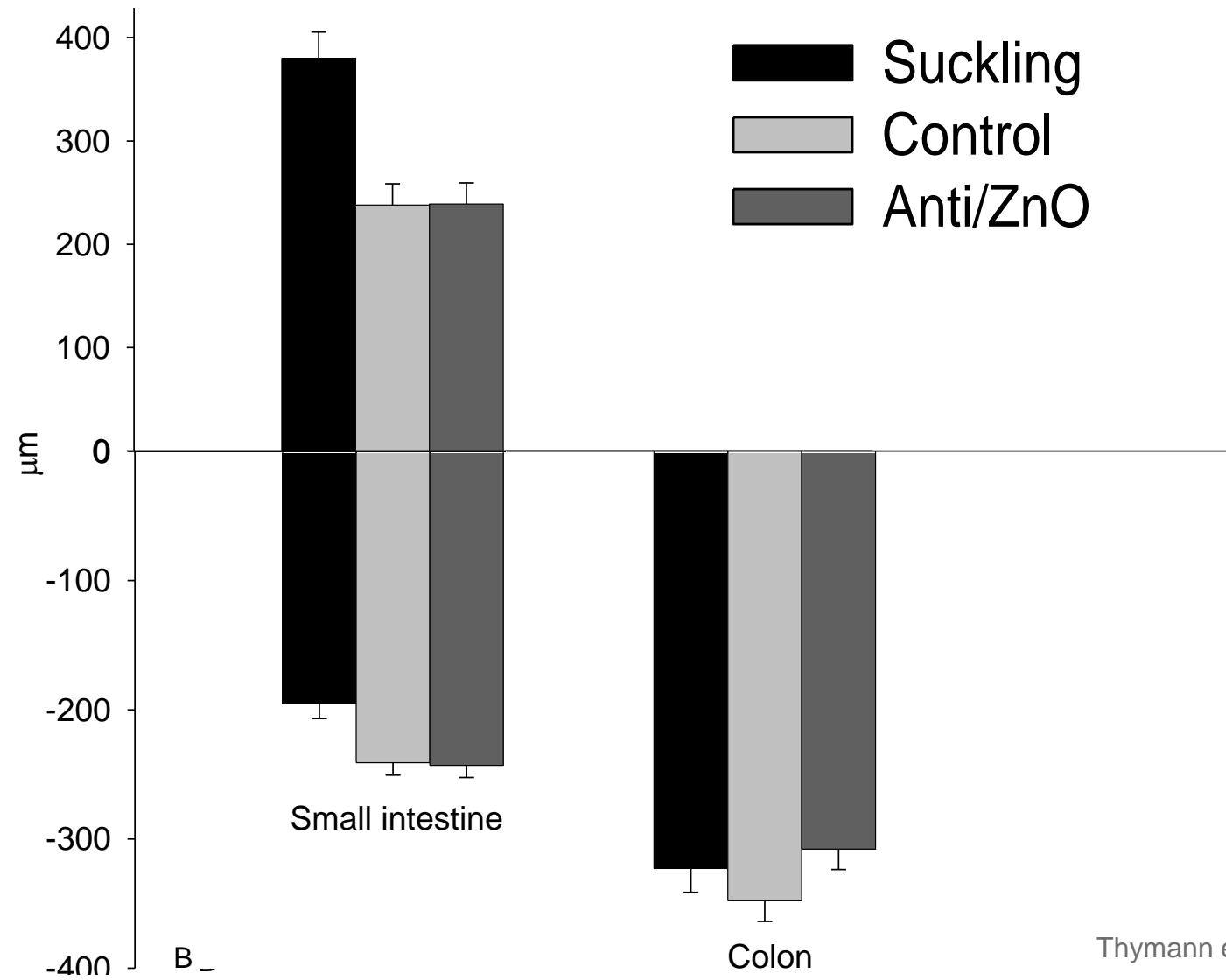
GLP-2 affects goblet cell density



- White bar: Suckling pigs, 28 d
- Red bar: Weaned pigs, 28+5 d, plant based
- Yellow bar: Weaned pigs, 28+5 d, milk based

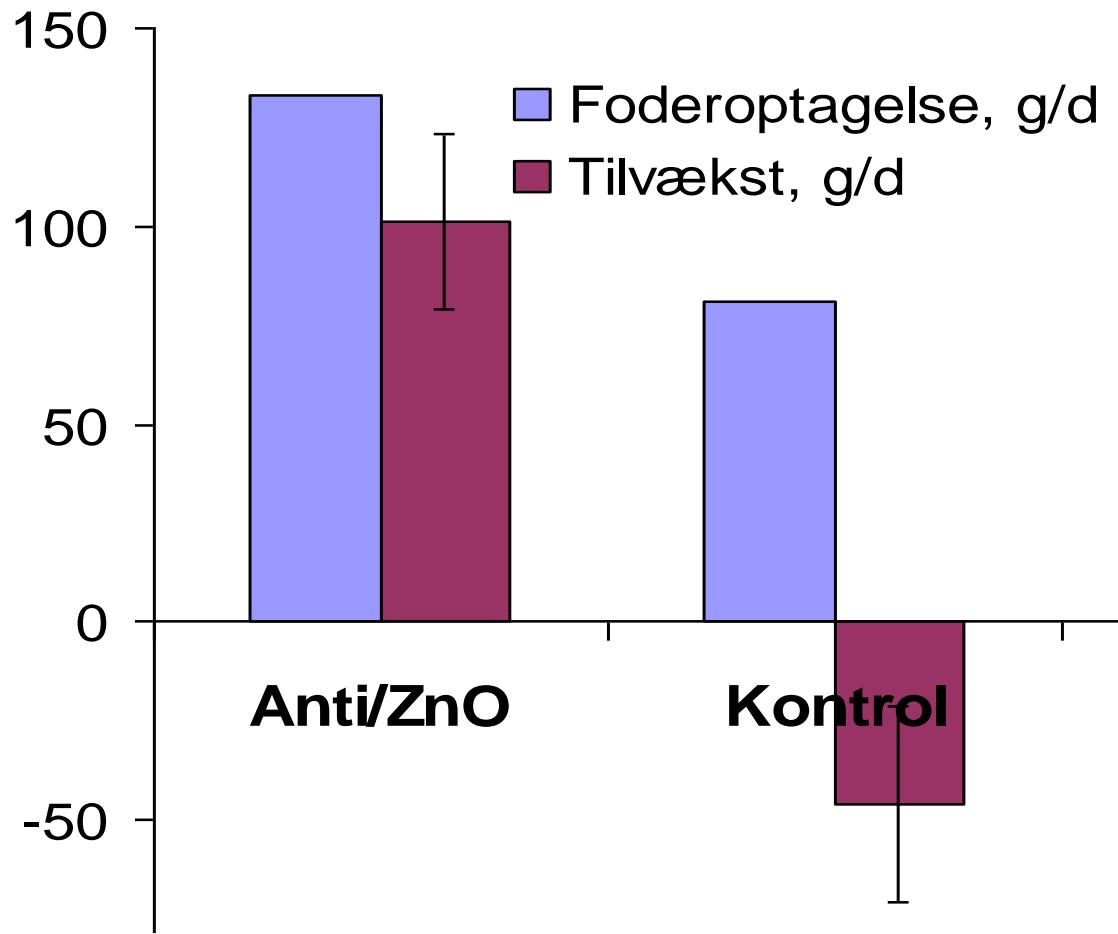


Villus atrophy in both sick and healthy weaned piglets

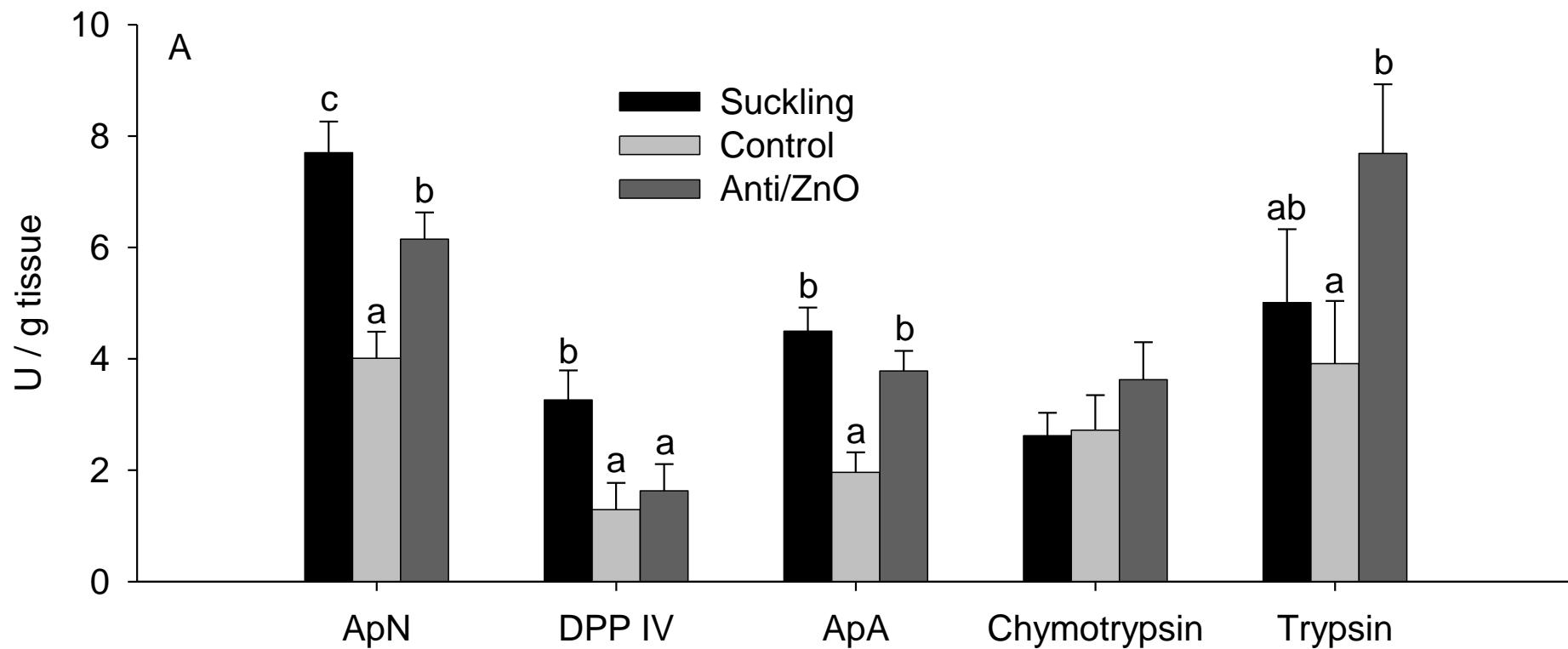


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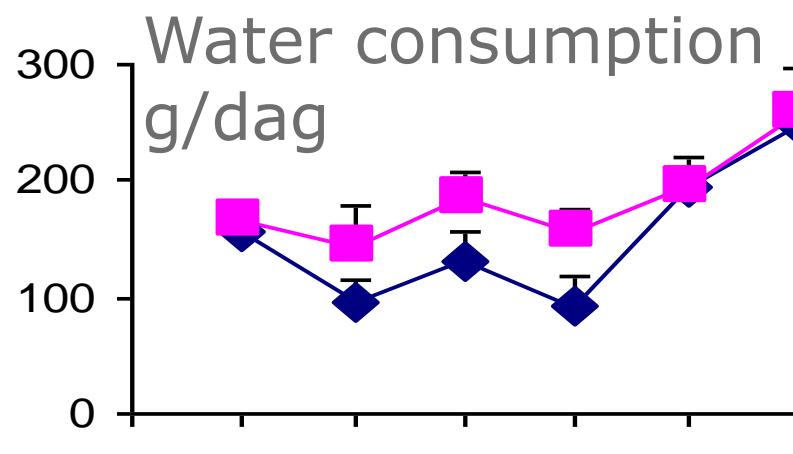
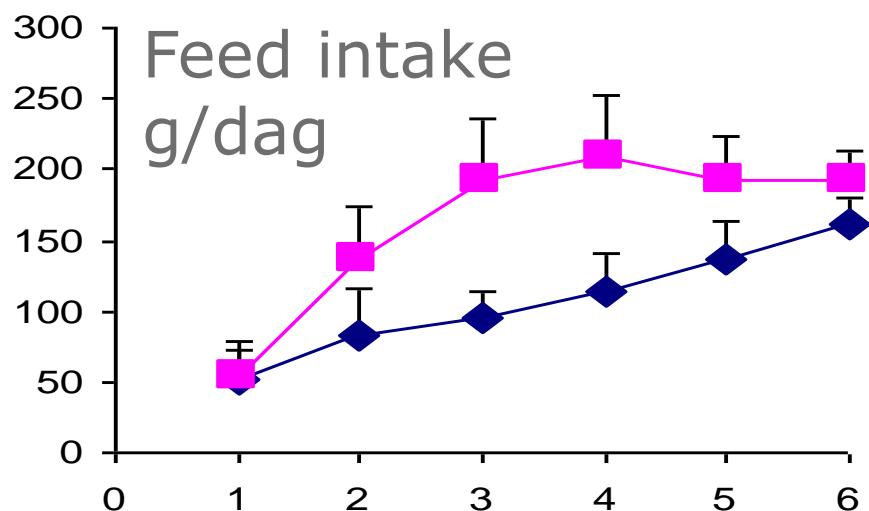
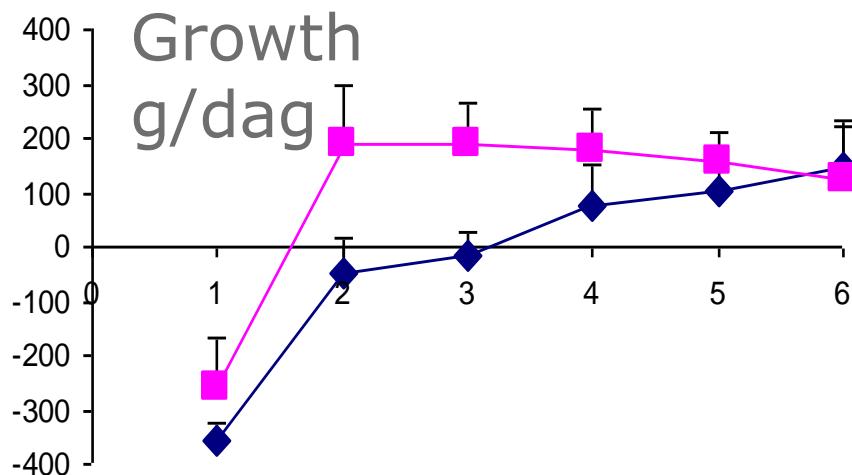
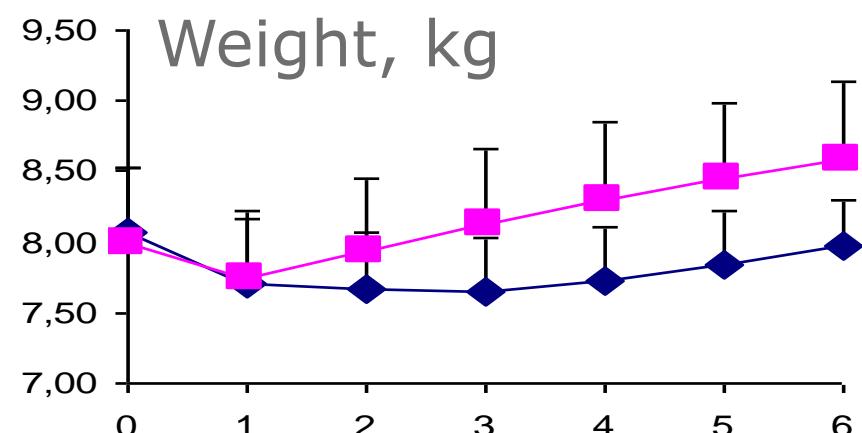




Diarrea reduces protein-digestion



Fasting-period before weaning

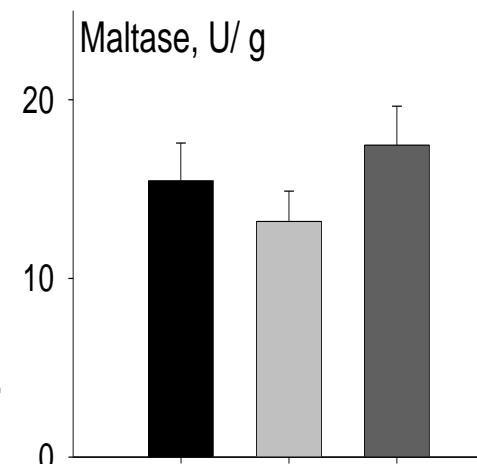
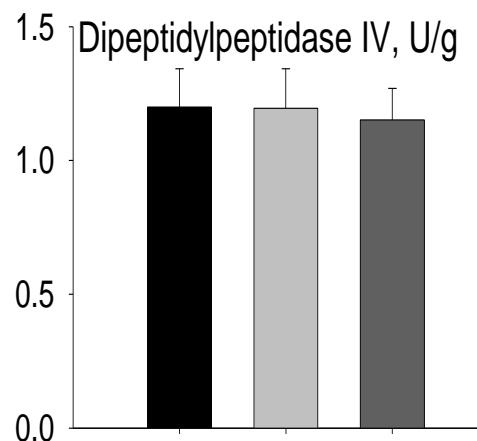
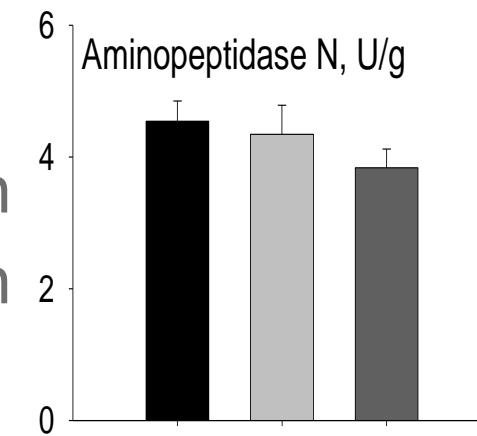
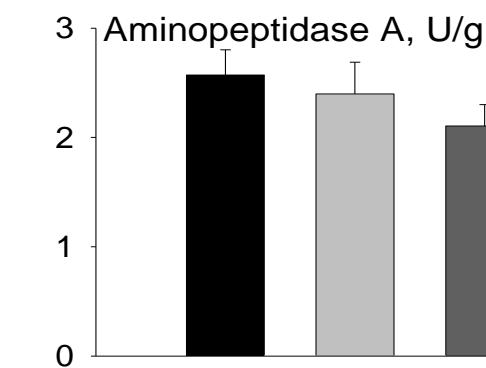
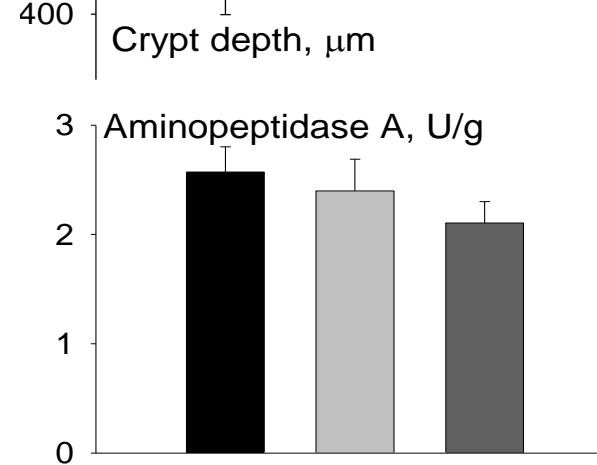
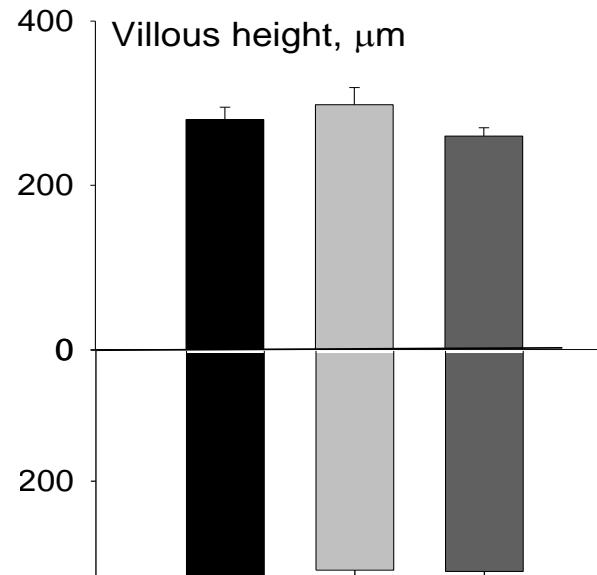


Days postweaning

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- Control
- 1x24 h fast during lactation
- 2x24 h fast during lactation



Thymann et al.



RESEARCH

Open Access



Artificial rearing influences the morphology, permeability and redox state of the gastrointestinal tract of low and normal birth weight piglets

Hans Vergauwen^{1†}, Jeroen Degroote^{2†}, Sara Prims¹, Wei Wang^{2,3}, Erik Fransen⁴, Stefaan De Smet³, Christophe Casteleyn¹, Steven Van Cruchten¹, Joris Michiels² and Chris Van Ginneken^{1*}

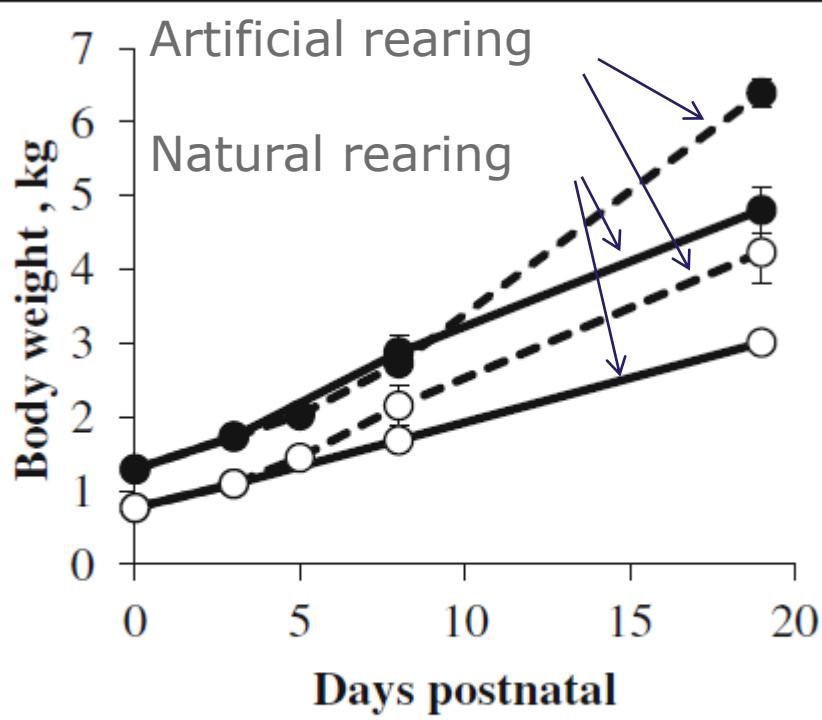


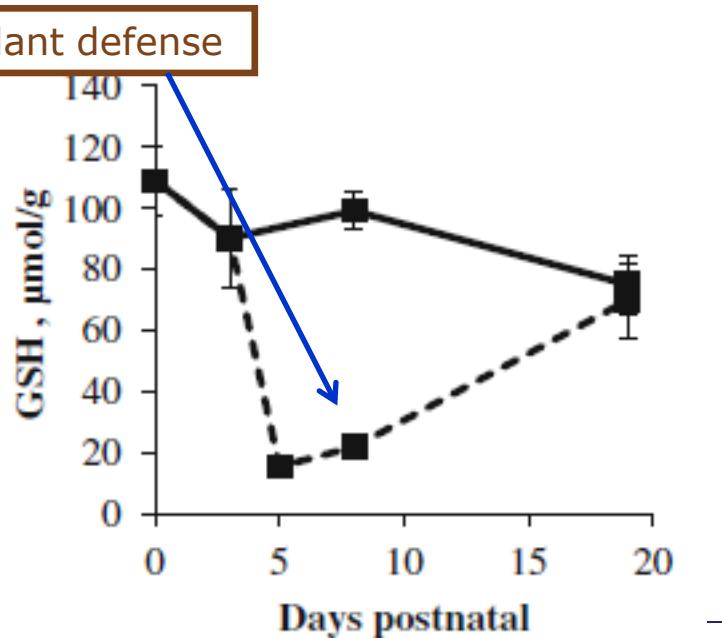
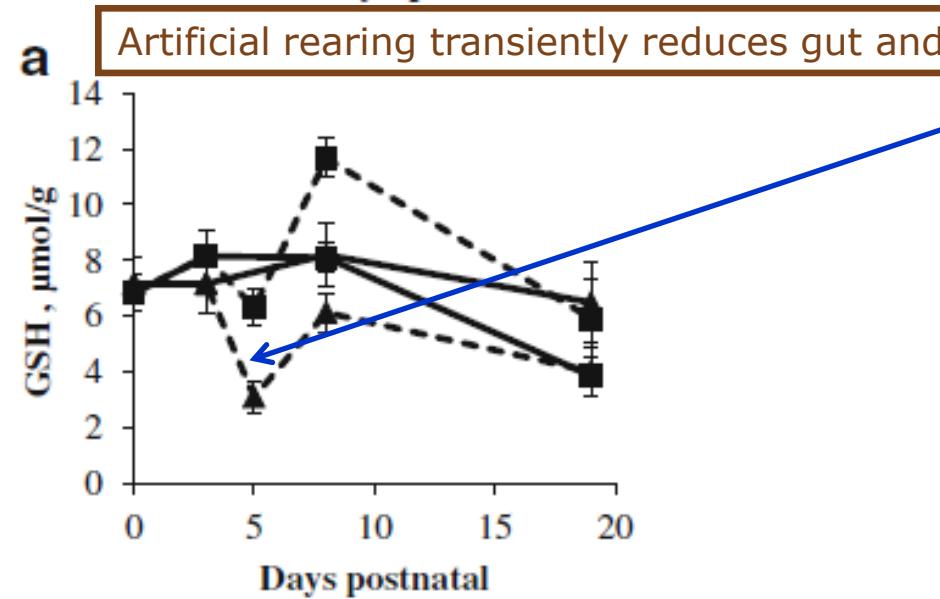
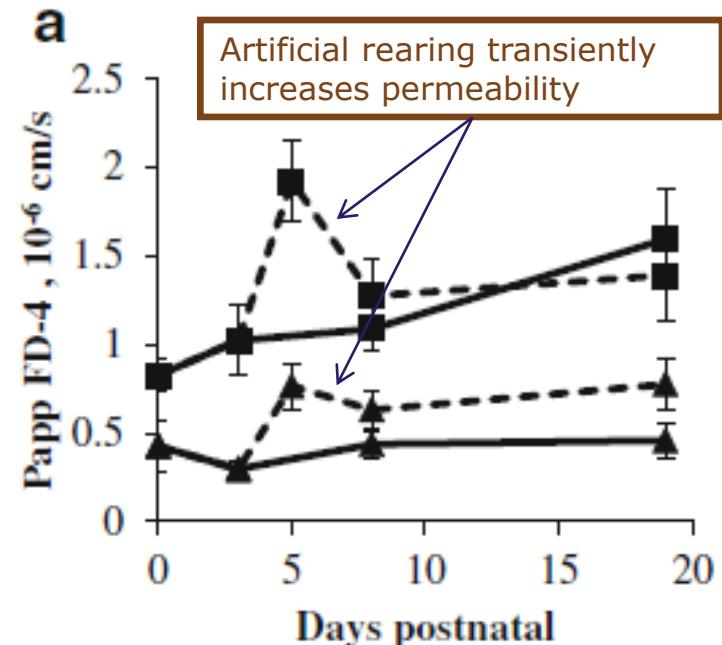
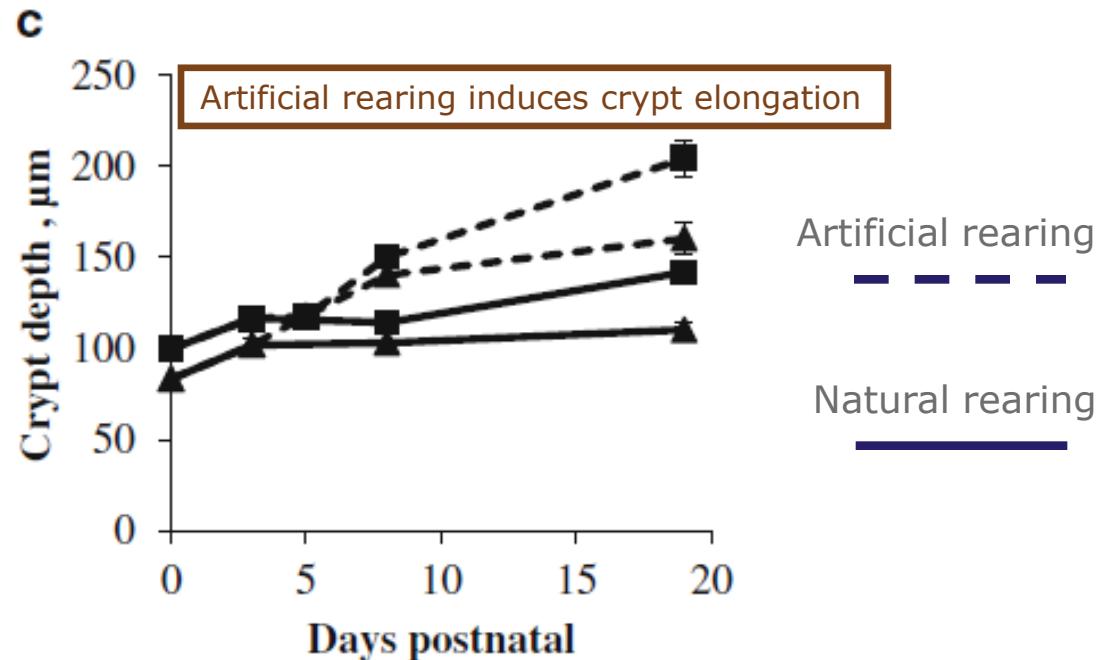
Fig. 1 Body weights (kg) of LBW (open circle) and NBW (closed circle) from sow- (full line) and artificially reared (dashed line) piglets during the suckling period. Values are means \pm SE ($n = 6$)

Table 1 Composition of the milk replacer used for piglets from 3 d of age until weaning at d 19

Ingredient composition, %

Coco fat filled whey 50/50	42.00
Skimmed milk powder	17.61
Whey permeate	8.29
Soy protein concentrate Soycomil K	10.00
Cheddar whey powder	8.29
Whey protein concentrate 80, DVN	7.00
Spray dried blood plasma P80	4.00
Dicalciumphosphate 18% P	0.32
DL-Methionine	0.31
Citric acid	0.30
L-Tryptophan	0.08
Vitamin and mineral premix ^a	1.8
Calculated nutrient levels	
NEv(1997) MJ/kg	15.48
CP, g/kg	249
CF, g/kg	110
dLYS, g/kg	18.2
dMET + CYS, g/kg	11.5
dTHR, g/kg	11.2
dTRY, g/kg	4.1

^aThe mineral and vitamin premix supplied as the following (per kg diet): Vitamin A, 30,000 IU; Vitamin D₃, 5000 IU; Vitamin E, 75 mg; Fe²⁺, 120 mg; Zn²⁺, 35 mg; Cu²⁺, 135 mg; Mn²⁺, 45 mg; Se⁶⁺, 350 µg; I, 1 mg; BHT, 75 mg/kg

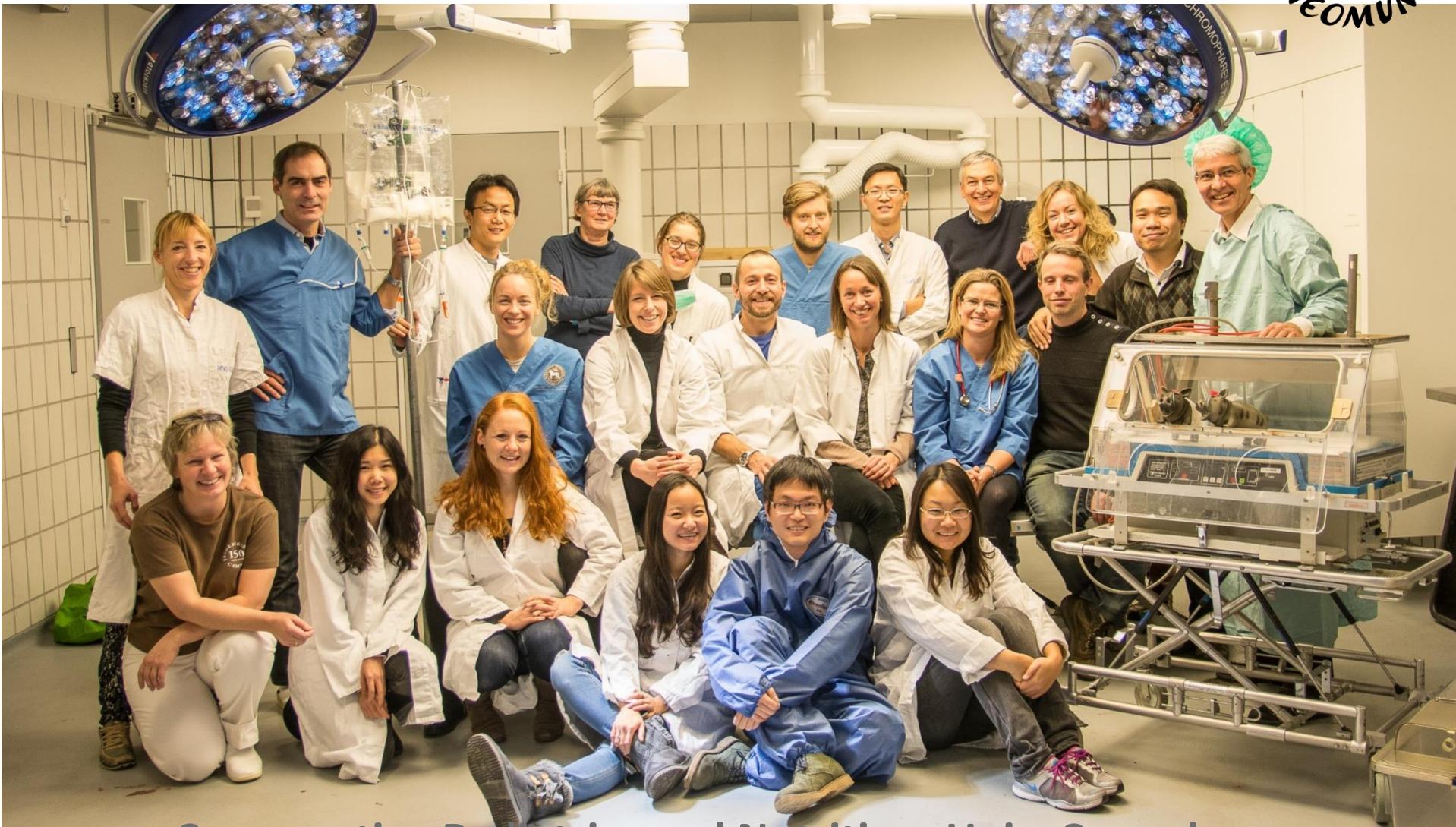


Hvordan skaber vi den robuste gris ?

- Udnyttet potentiale i diegivningsperioden
- Tarmens morfologi og funktion vanskelig at påvirke de første tre uger.
- Derfor højkvalitets mælke-blandinger for alene at sikre overlevelse og vækst de første 2-3 uger.
- Tarmen mere påvirkelig for vegetabiliske råvarer i uge 4 og 5. Alder vigtigere end vægt
- Forbigående små tarmskader kan accelerere tarmens modning (ex. mælkeerstatninger, intermitterende diegivning).



Tak for opmærksomheden



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