Perinatal gastroenterology, microbiology, nutrition

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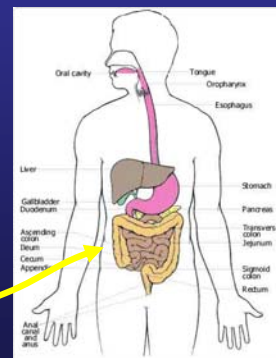**Doug Burrin**

Mette Schmidt
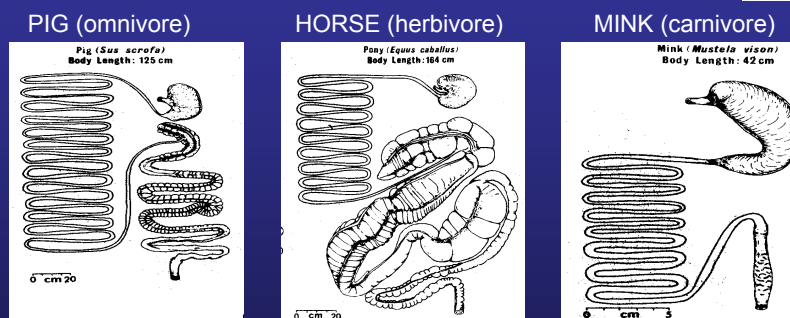
Lars Mølbak

Mette Boye

Animal models in
pre – and probiotic research?

?

What is a good model for gut-nutrition-microflora?

1) Similarity in key nutrition-relevant organs/tissues?
(gastrointestinal tract, liver, metabolism..…)

2) Similarity in natural dietary habits?
(herbivore, omnivore, carnivore, meal pattern, seasonal changes….)

3) Spontaneous nutrion-related diseases
(e.g. type-2, CHD, obesity, allergy, malabsorption, atherosclerosis…?)

4) Life cycle development & body composition
(maturity at birth, life span, nutritional transitions…..)

Gut anatomy - a key factor for species-specific nutrition & gut microflora

PIG (omnivore)   HORSE (herbivore)   MINK (carnivore)

Pig (Sus scrofa)
Body Length: 125 cm
0 cm 20

Pony (Equus caballus)
Body Length: 164 cm
0 cm 20

Mink (Mustela vison)
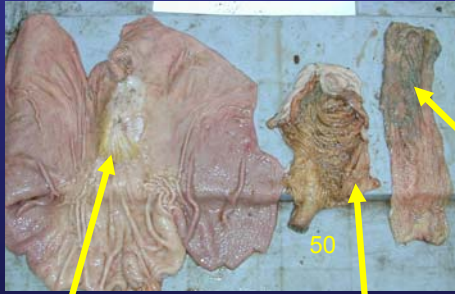Body Length: 42 cm
0 cm 3

Similar tissue/cell metabolism

Nutrition/mrobiota-related gut disease:

DP Burkitt (1975):
Big fæces ➡ Small hospitals
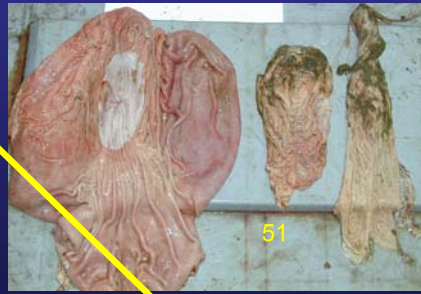Small faeces ➡ Big hospitals

High fat – low fiber:

Low fat – high fiber:

Stomach   Caecum   Colon

50

51

Stomach: Keratinization and mild erosive damage (early ulcer)
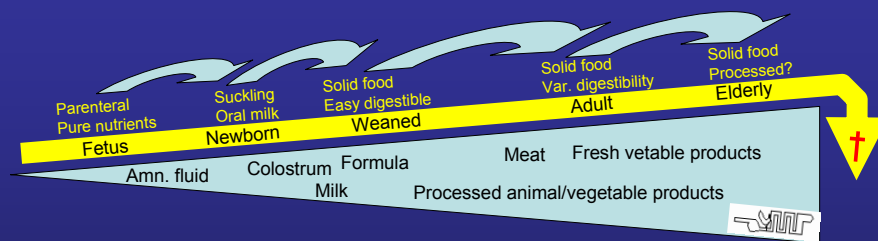
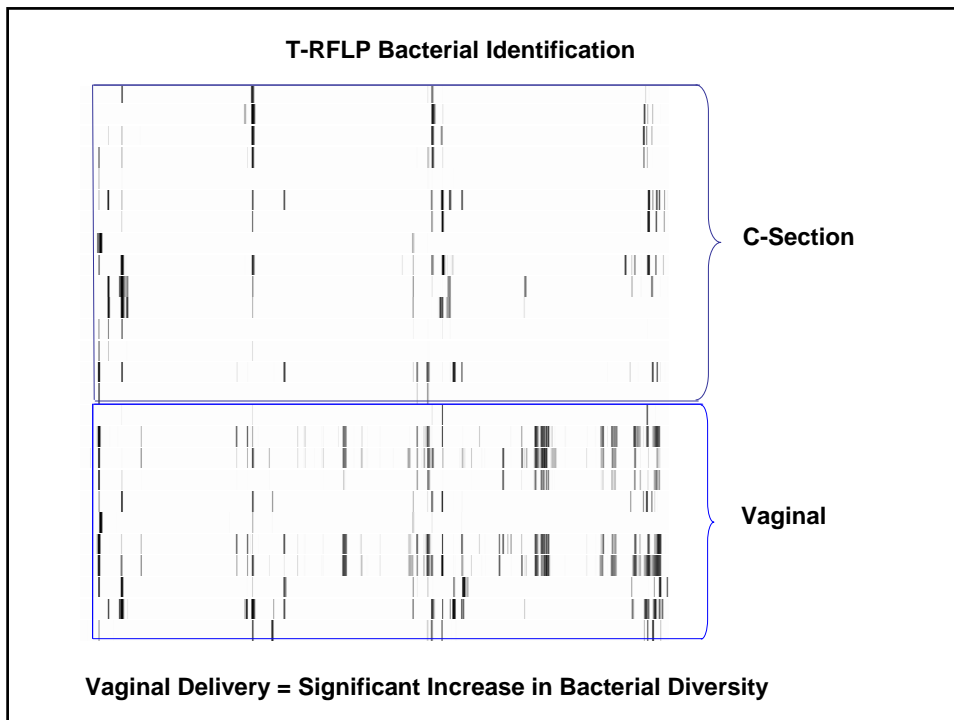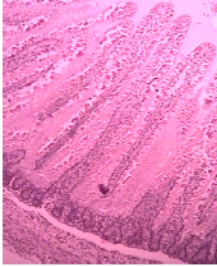Caecum: Red/brown/yellow inflamed mucosal surface
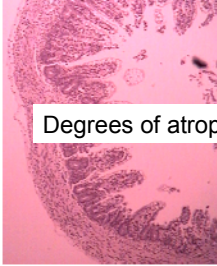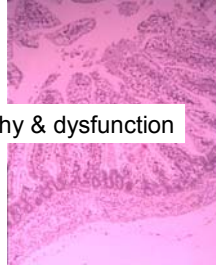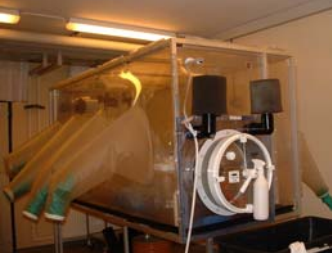
Colon: Sticky food material with much epithelial contact

Developmental Nutrition & Microbiology

Parenteral
Pure nutrients

Suckling
Oral milk

Solid food
Easy digestible

Solid food
Var. digestibility

Solid food
Processed?

Elderly

Adult

Weaned

Newborn

Fetus

Amn. fluid

Colostrum Formula

Milk

Meat   Fresh vetable products

Processed animal/vegetable products

†

T-RFLP Bacterial Identification

C-Section

Vaginal

Vaginal Delivery = Significant Increase in Bacterial Diversity

# Is gut microflora crucial?

Vaginal or Caesarean - Conventional

Colostrum | Formula | Formula

Degrees of atrophy & dysfunction

Germ free (sterile)

Formula

Happy gut!

Pig NICU

Am. J. Physiol. 294, 2008

Gastroenterology 130, 2006

Diet, prematurity & gut microbiology

PCA (Principal Component Analysis) of gut microbiology in newborn pigs

Term suckling pigs
Term formula-fed AR pigs
Preterm healthy AR pigs
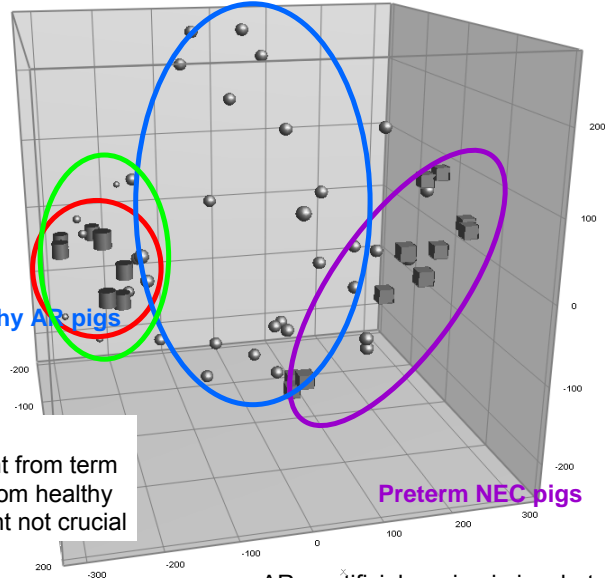
CONCLUSIONS:
- Preterm different from term
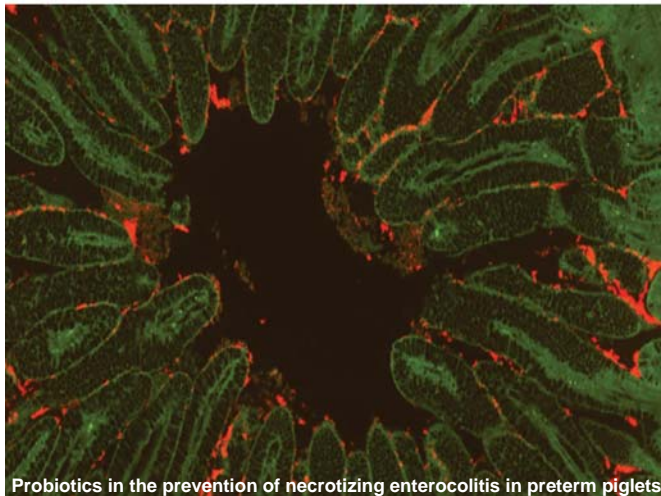- NEC different from healthy
- Diet/environment not crucial

Preterm NEC pigs

(Cilieborg et al., unpublished)

AR = artificial rearing in incubators

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Bifidobacterium animalis
Lactobacillus acidophilus
Lactobacillus casei
Lactobacillus pentosus
Lactobacillus plantarum

10^{10}/d during TPN/formula

NEC score ↓
Structure ↑
Function ↑
Fermentation ↓
Clostridium ↓
Commensals ↑

Probiotics in the prevention of necrotizing enterocolitis in preterm piglets