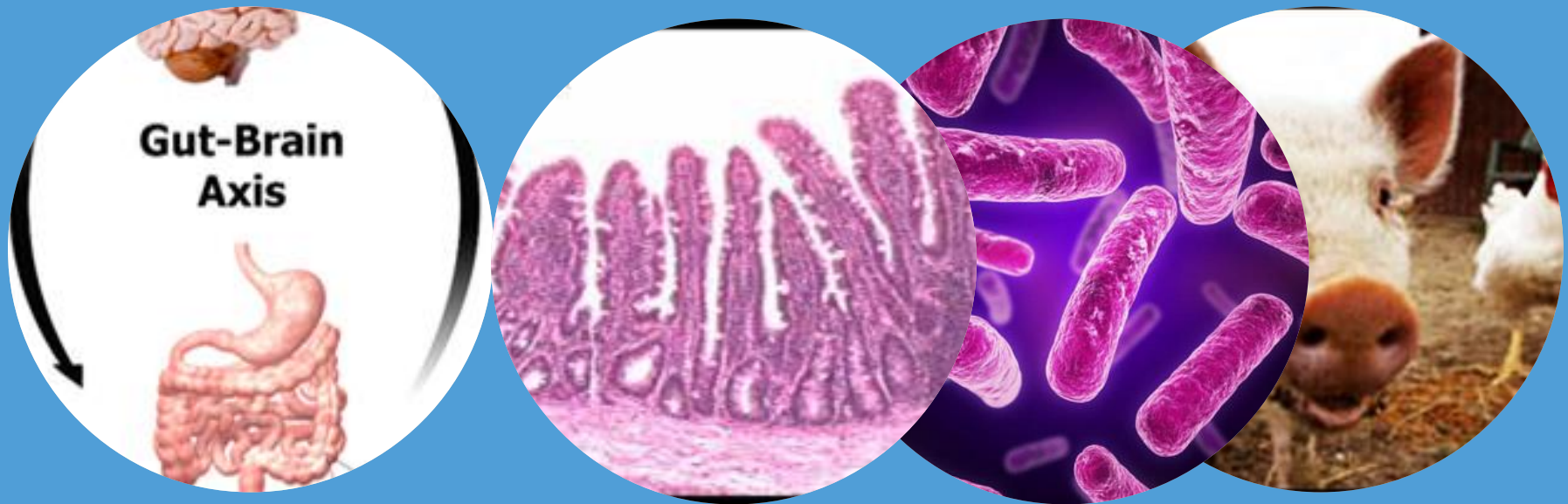


Gut to Brain?

Mari Smits

15-05-2017



Beginning and End

Diseases

Pathogens

**Control / Prevention
Vaccines / Diagnostics**

What happened ->

?

?

Gut-health

**Immune
competence**

**Microbiota
Nutrition
Management**



Beginning

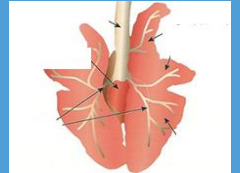
- **Atrophic rhinitis**

- *Pasteurella multocida*



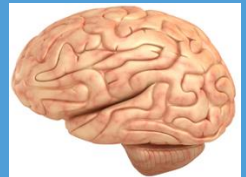
- **Pleuropneumoniae**

- *Actinobacillus pleuropneumoniae*



- **Transmissible Spongiform Encephalopathies**

- Prions



Transmissible Spongiform Encephalopathies

Diseases

Pathogens

Control / Prevention



**Scrapie
BSE**



**Prion Protein
Host Gene**

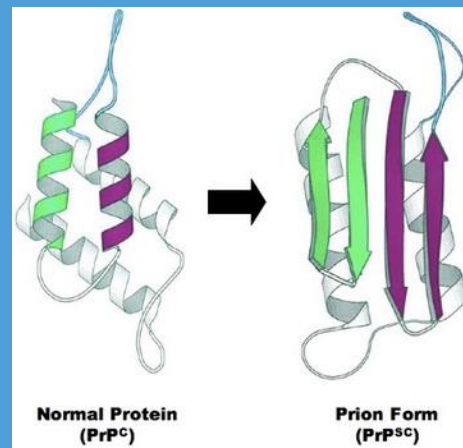


**Eradicate
Susceptible
Allele**



What I learned from the prion research

It is possible to control and/or prevent prion diseases by optimizing some of the intrinsic properties of susceptible hosts



Follow-up challenge

Is it possible to control and/or prevent **other infectious diseases** by optimizing some of the intrinsic properties of susceptible hosts?

Related question

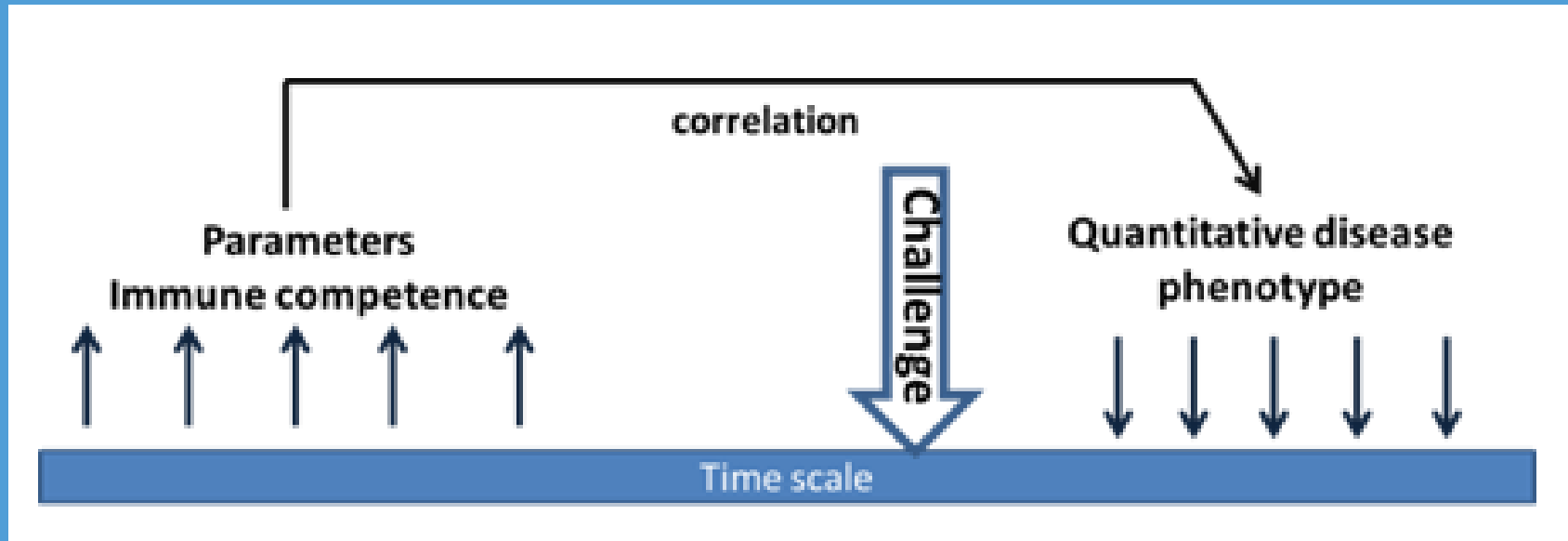
Which intrinsic properties of hosts need to be optimized to better control / prevent other infectious diseases?

Immune competence

What is Immune competence?

- The ability of the immune system to respond appropriately to an antigenic stimulation by the generation of an effective immune response
- For high producing livestock: a good balance between inflammation and immune tolerance is required
- Immune competence is not equal to immune response

What is Immune competence?



Immune competence

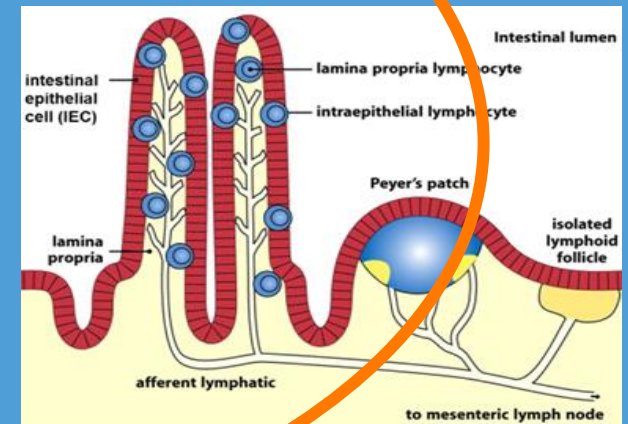
Immune response

Immune competence dependencies

- **Genes:** $n > 1000$
 - Encode for the structural elements of the immune system
- **Programming:**
 - Self, non-self antigens
 - MHC
 - Distinguish harmful from harmless antigens
 - Microbial populations that colonize the gut during early life
- **Cellular health**
 - Supply of energy and nutrients

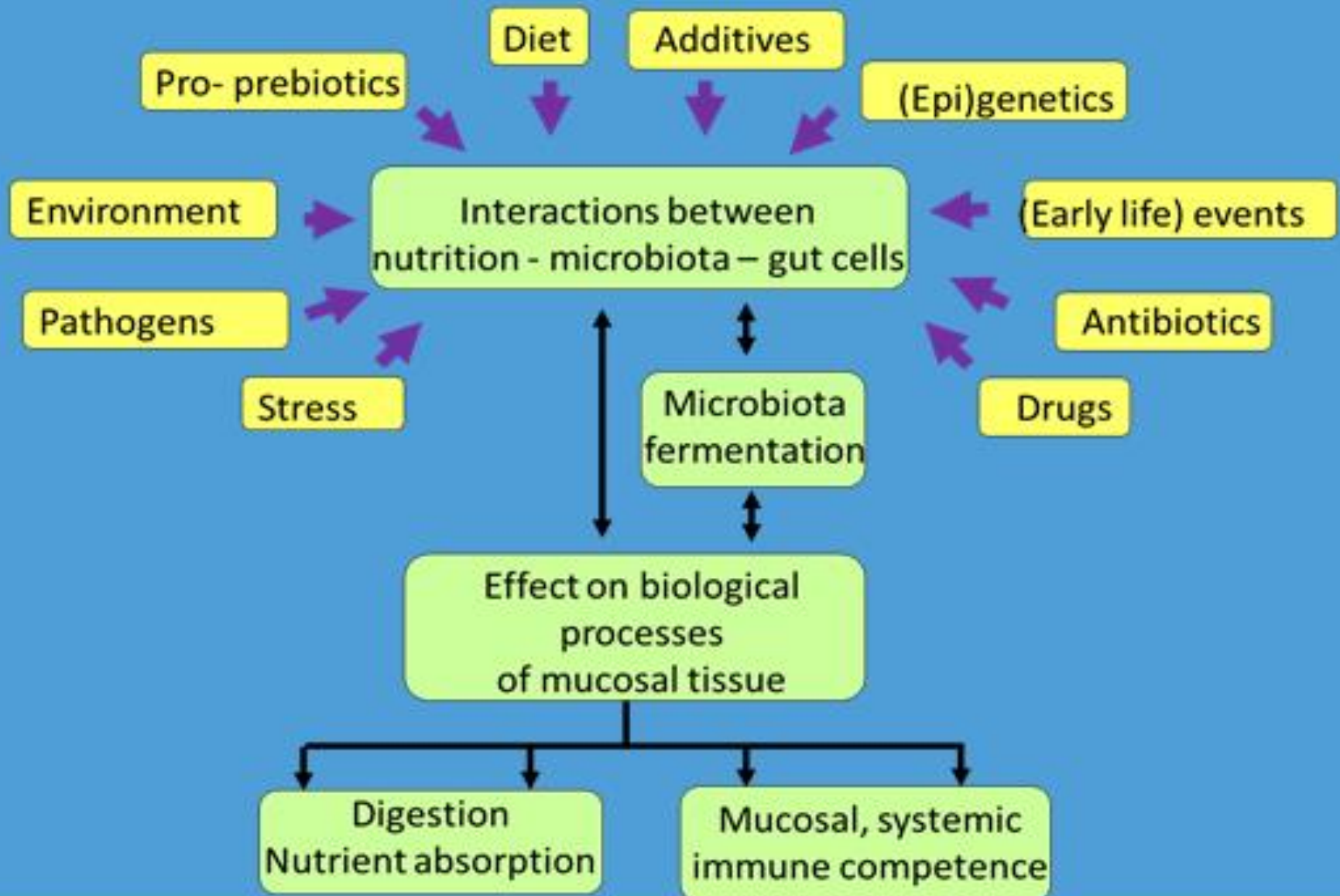
How to modulate immune competence?

- Genes
 - Quantitative genetics and genomic approaches
- Programming
 - Study host – microbe interactions in the gut
- Cellular health
 - Nutrigenomic approaches



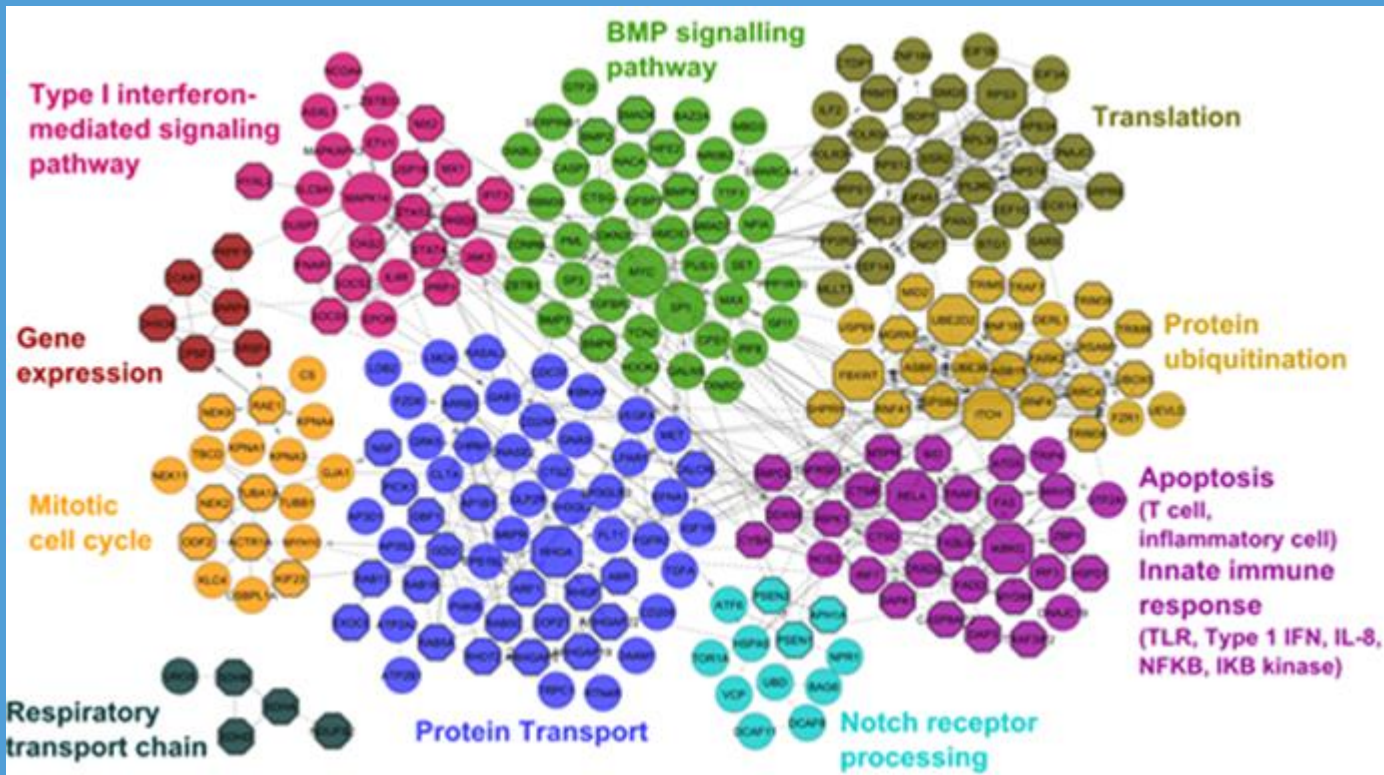
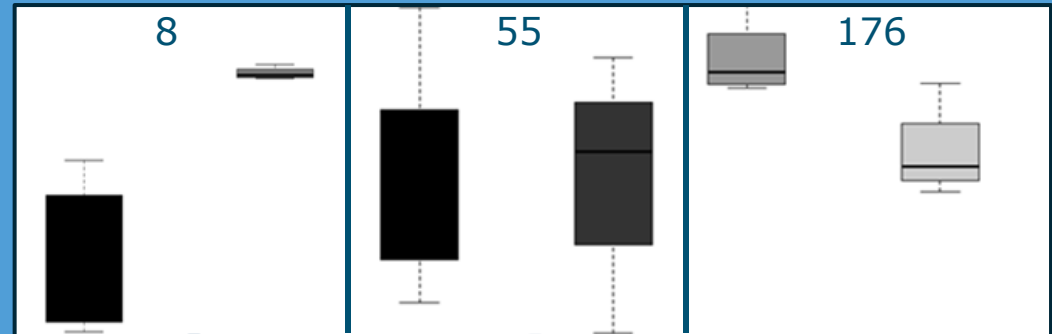
70% immune cells in gut mucosa

Working on interaction in the gut is exciting and requires multi-disciplinarity



Antibiotic injection in piglets at day 4 after birth

Diversity
Intestinal
microbiota



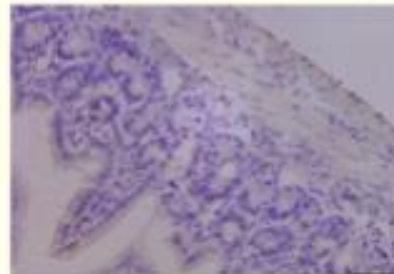
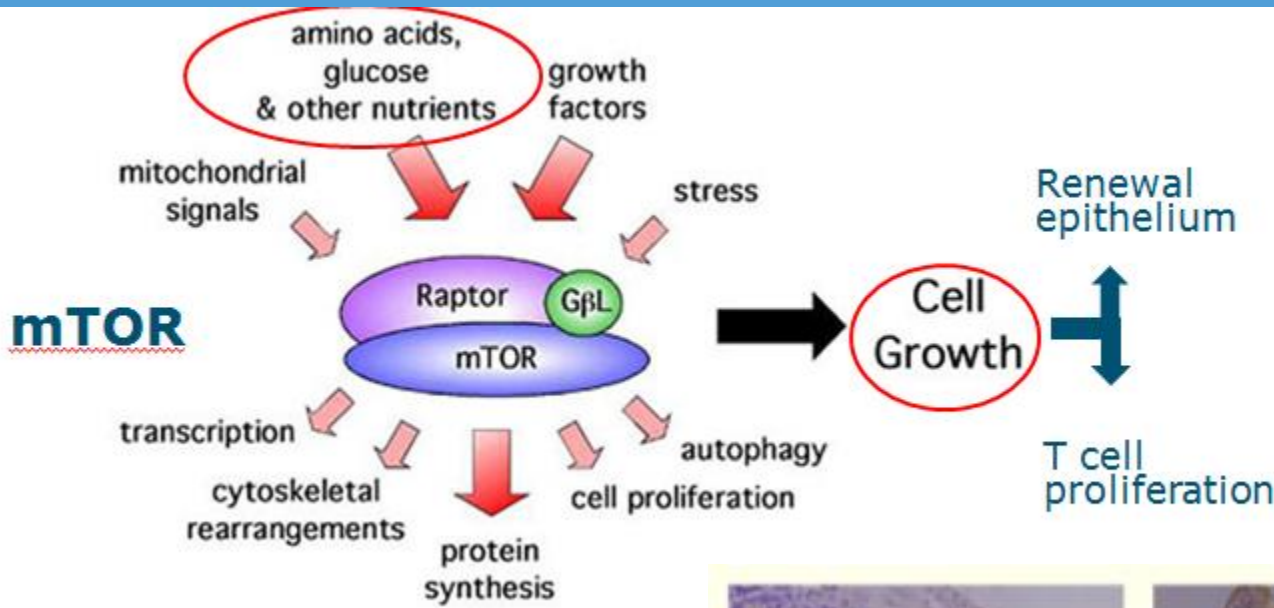
Mucosal gene
expression
Days 8, 55, 176

Dietary interventions: Summary of results

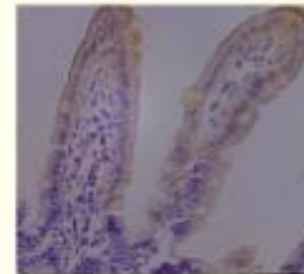
- Feed additives
 - -> effect on microbiota in neonatal and adult piglets and chickens
 - -> effects on functionality intestinal mucosa (immune, barrier function, cellproliferation, metabolism)
- Dietary intervention
 - later life -> temporary effects
 - early life -> life-long effects
- Intervention route matters
- Microbiota drive immune and metabolic programming



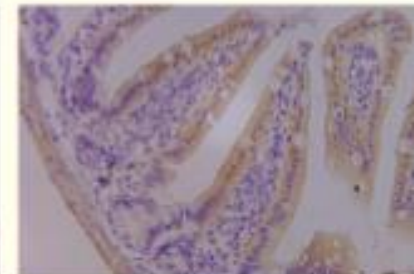
Cellular health



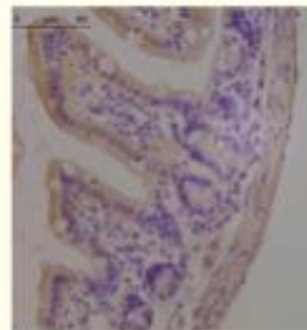
SBM



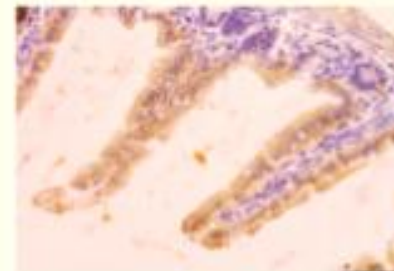
CAS



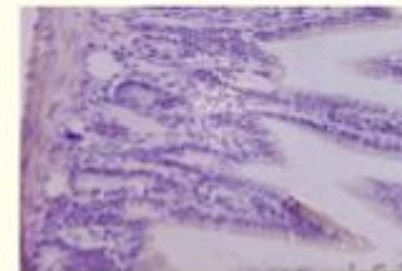
DWP



SDPP



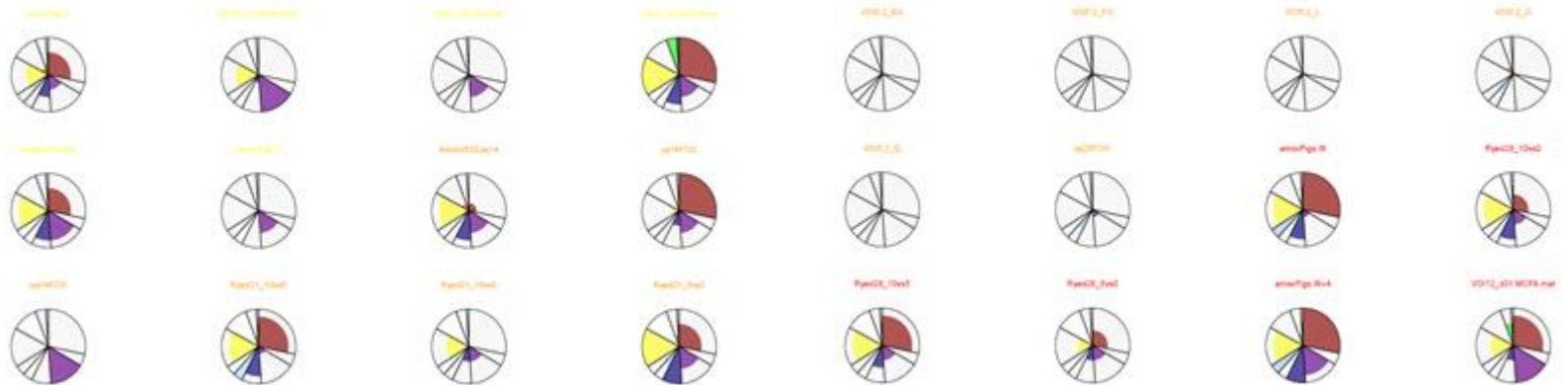
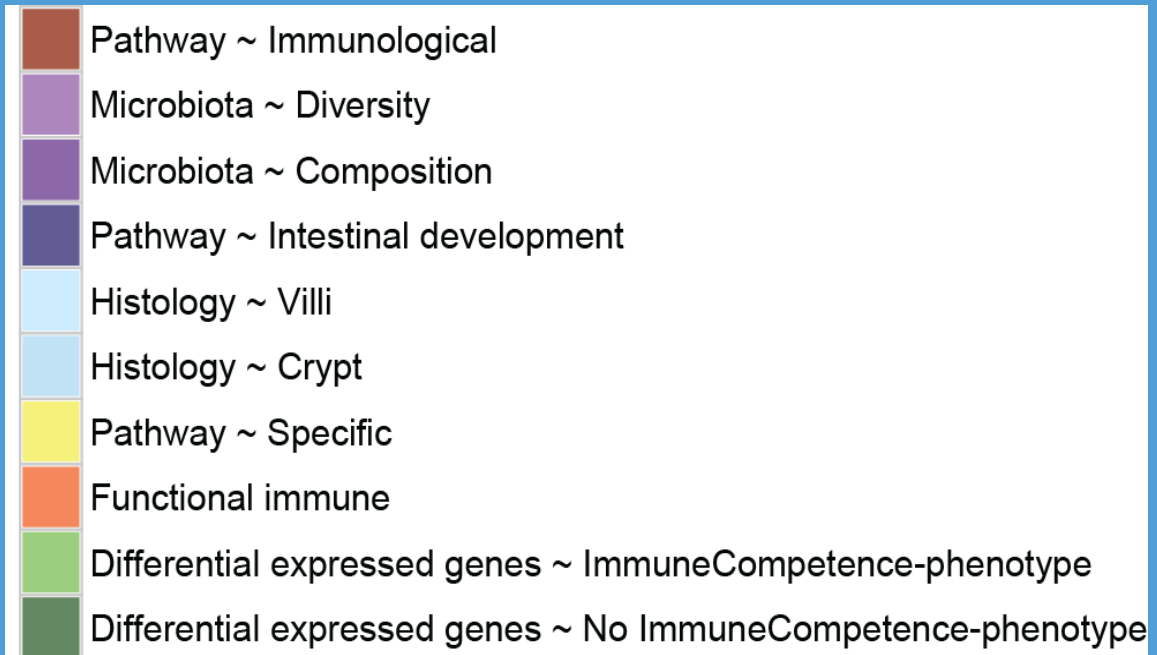
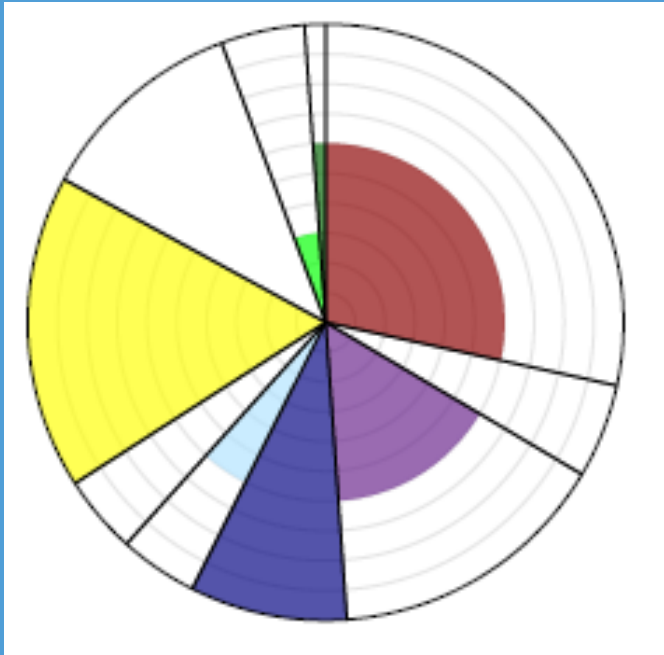
WGM



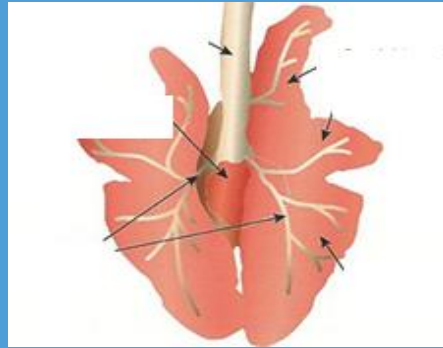
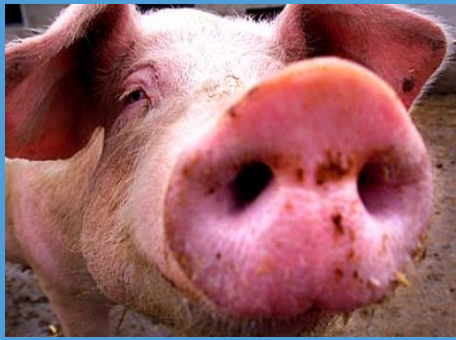
YMW



How to "measure" immune competence



Gut to Brain? Nose to Lung to Brain to Gut



Thank you

- Supporting staff
 - Technician
 - PhD students
 - Junior scientists
 - Senior scientists
- Heads of departments
- Chair holders of departments
 - Directors of institutes
- Boards of Wageningen University & Research
 - Jodine, Martina, Ruben + Esmée
 - Thilly

What I wish you all

- @Work

“GUTS” and BRAINS

- @Home

GUT-HEALTH and HAPPY BRAINS



Thank you



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