

XLIII meeting annuale SIPAS
16-17 Marzo 2017 – Reggio Emilia

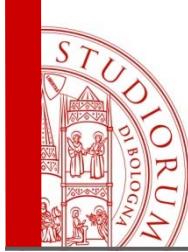


Società Italiana di Patologia
ed Allevamento dei Suini
S.I.P.A.S. www.sipas.org

Strategie alimentari per contenere l'uso di antibiotici nel suino

Paolo Trevisi

Dipartimento di Scienze e Tecnologie Agroalimentari – Università di Bologna



Parola Chiave: health diet pig

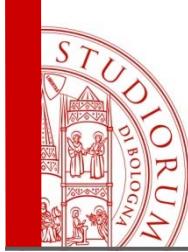
Anni di riferimento: dal 2016

Risultati: Circa 19.600

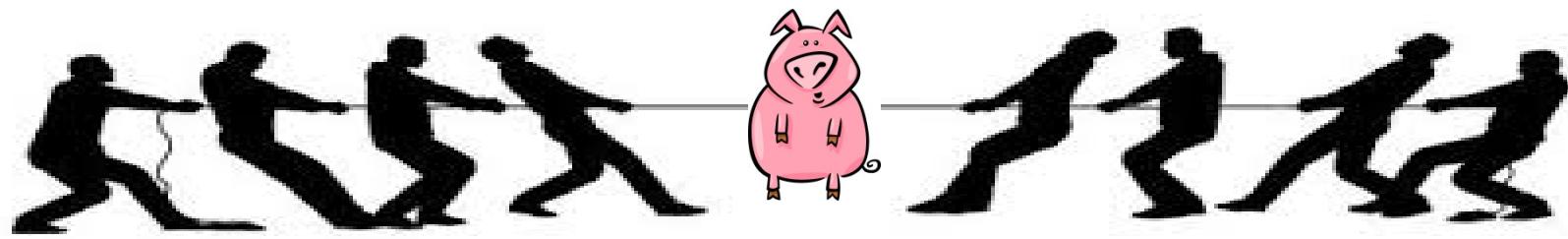
Parola Chiave: reduction use of antibiotic diet pig

Anni di riferimento: dal 2016

Risultati: Circa 8.220



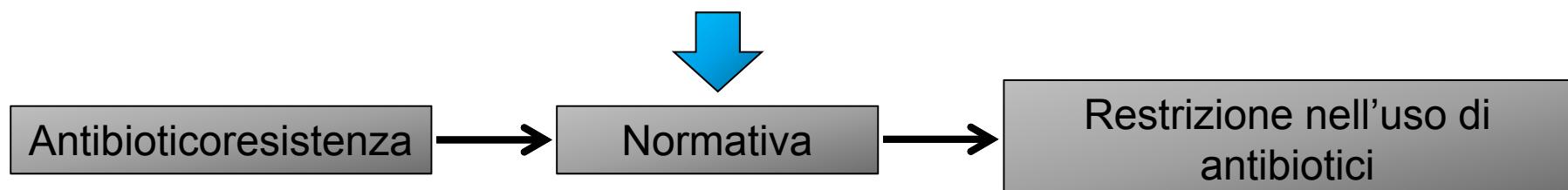
Introduzione

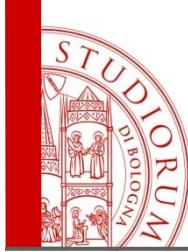


Stato di salute

Performance di crescita

EU - dal 2006 divieto APC → (ab)uso di terapeutici

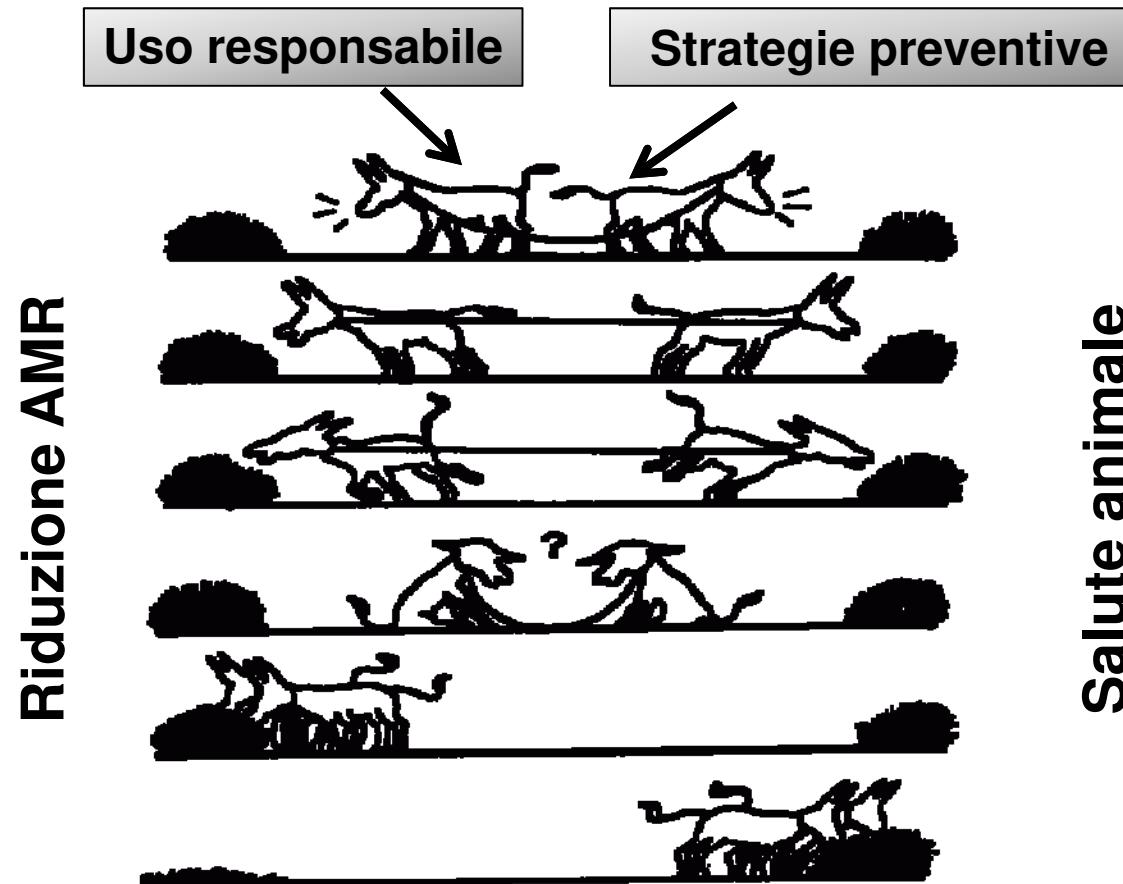


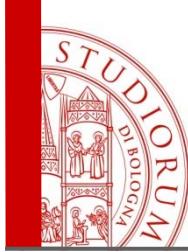


Introduzione

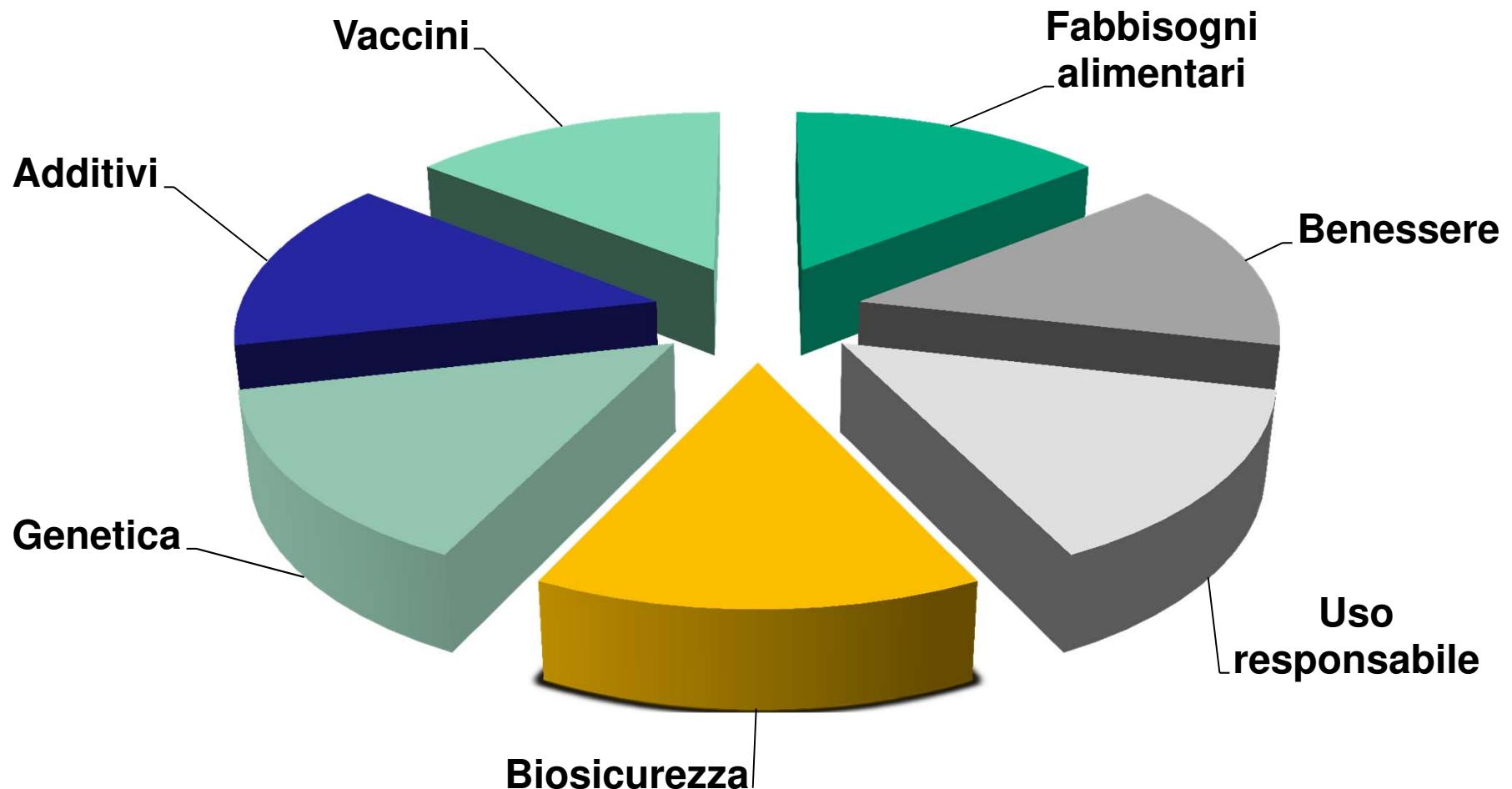
COMMISSION NOTICE

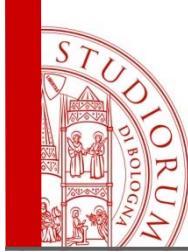
Linee guida per l'uso prudente di antimicrobici in medicina veterinaria (2015/C 299/04)



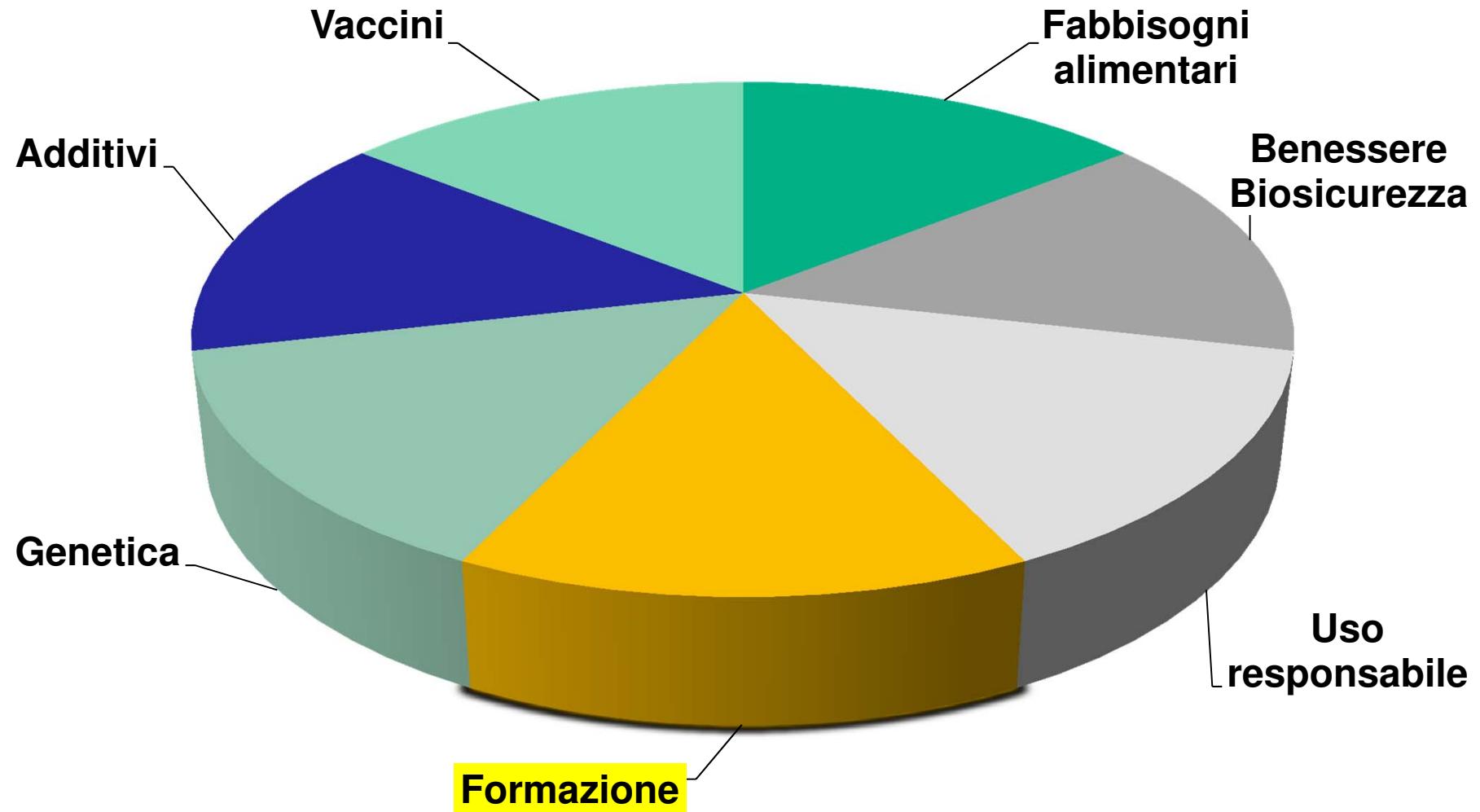


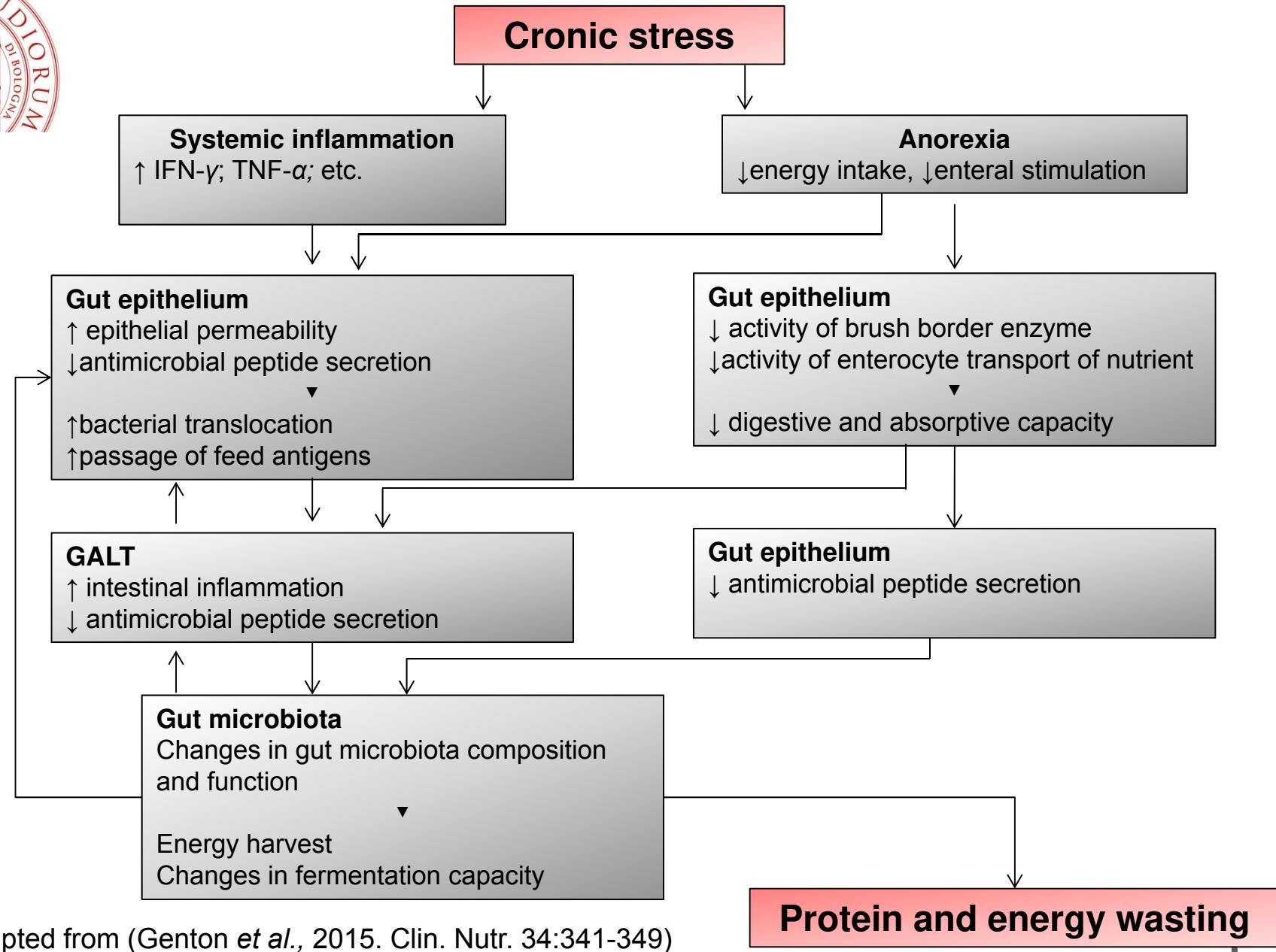
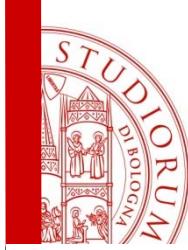
Approccio basato su singole strategie



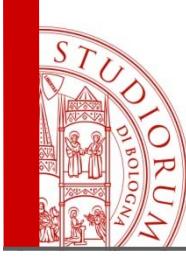


More is different – Philip Anderson

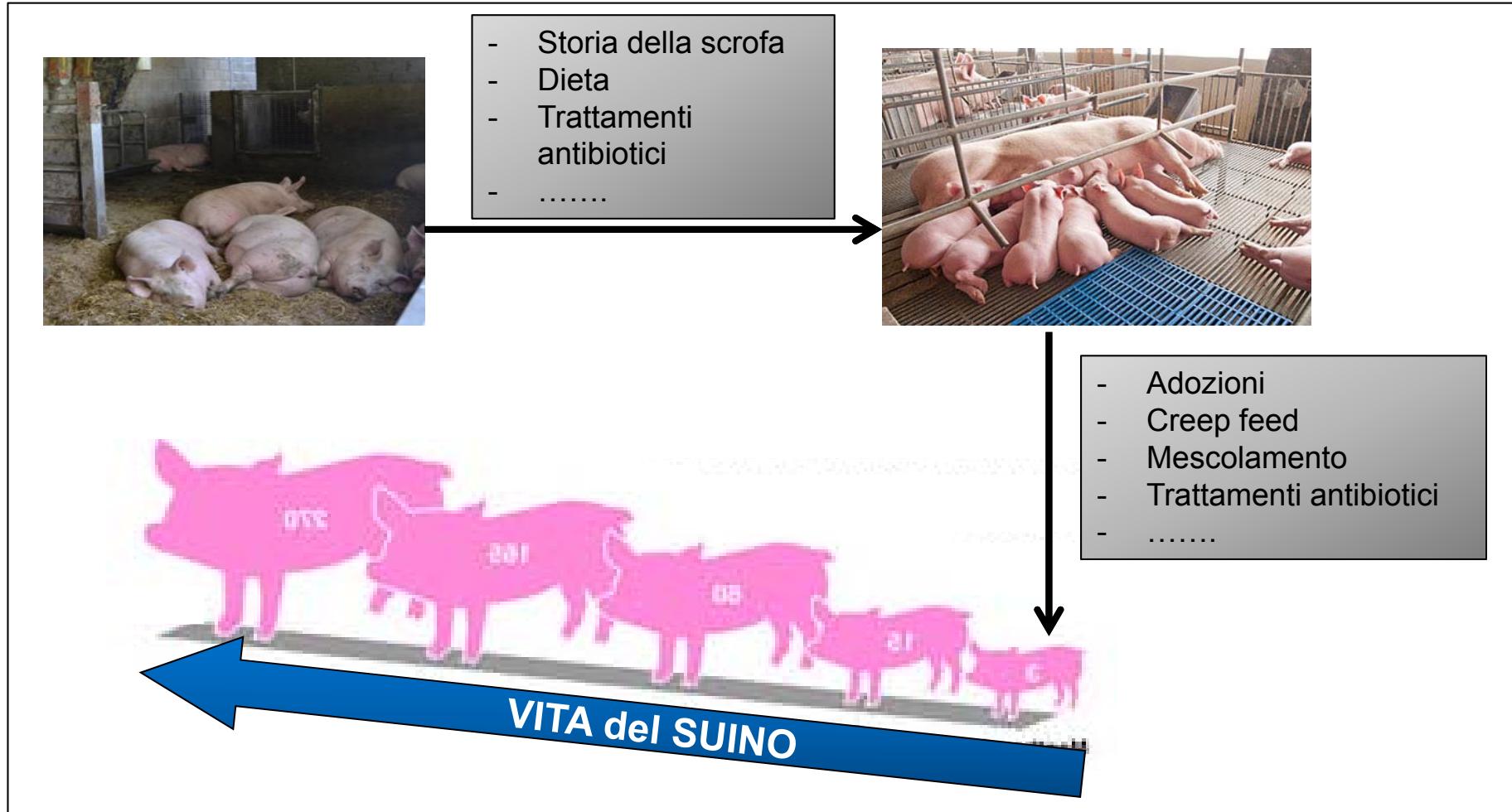


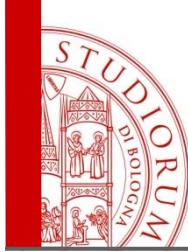


Adapted from (Genton *et al.*, 2015. Clin. Nutr. 34:341-349)



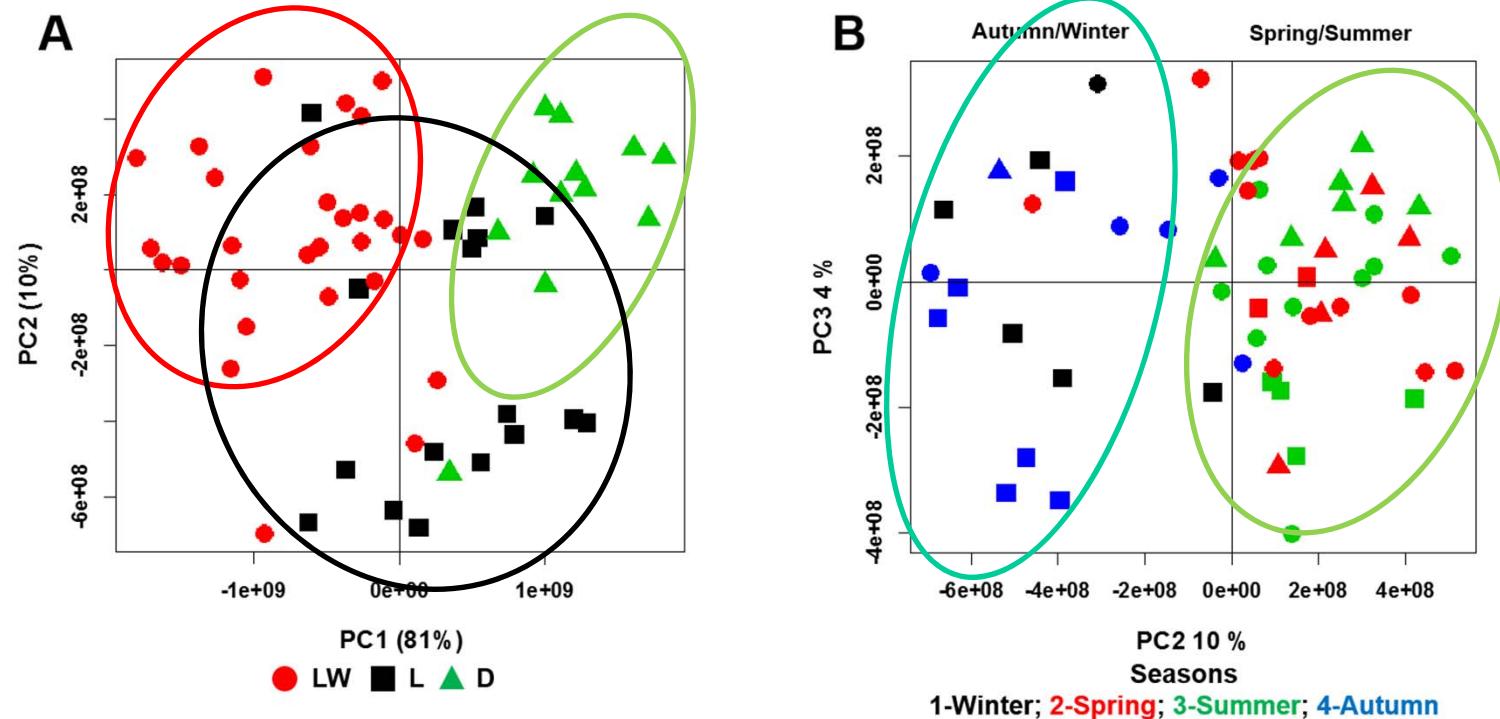
Il concetto di continuità



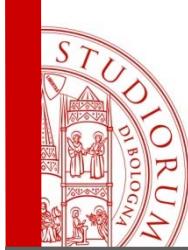


Pre-svezzamento

Caratterizzazione del colostro di scrofa

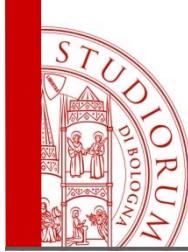


Trevisi et al. 2017 submitted



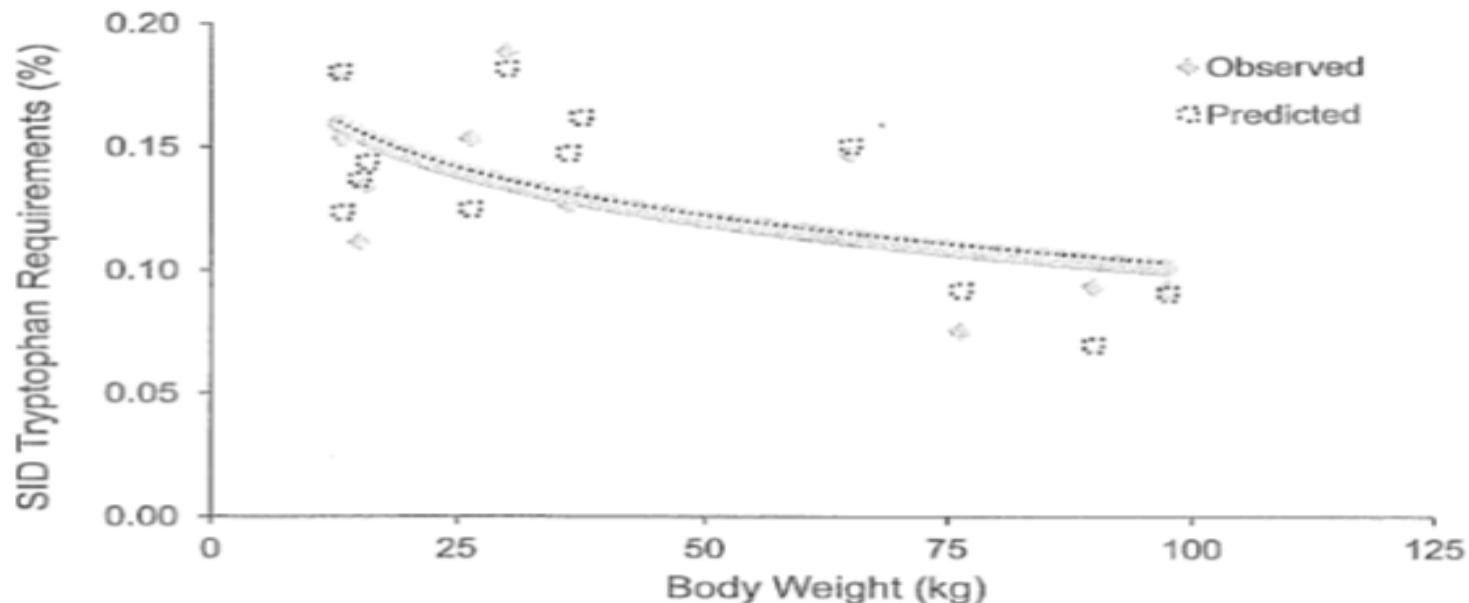
Effetto dei componenti del colostro su parametri produttivi

Variables	Coefficient	SE coefficient	F value	P-value
Modelo per IP dalla nascita al terzo giorno di vita ($R^2 = 0.4286$)				
Intercept	0.715	0.533	1.79	0.186
Acetate	0.10433	0.03348	9.71	0.0029
Modello per il numero di suinetti morti per nidiata al giorno 3 ($R^2 = 0.2304$)				
Intercept	-0.333	0.27	1.44	0.2352
Dimethylamine	0.33082	0.08318	15.82	0.0002
Taurine	-0.11423	0.04432	6.64	0.0127
Modello per il numero di suinetti svezzati ($R^2 = 0.4343$)				
Intercept	4.801	1.385	12.01	0.001
Cis- Aconitate	-0.90181	0.37157	5.89	0.0185



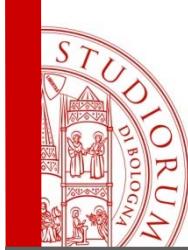
Post-svezzamento

Variabilità nella predizione dei fabbisogno alimentari (l'esempio del Triptofano)



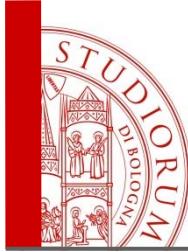
Curva di predizione per suini in accrescimento NRC2012)

Come spiegare la variabilità?



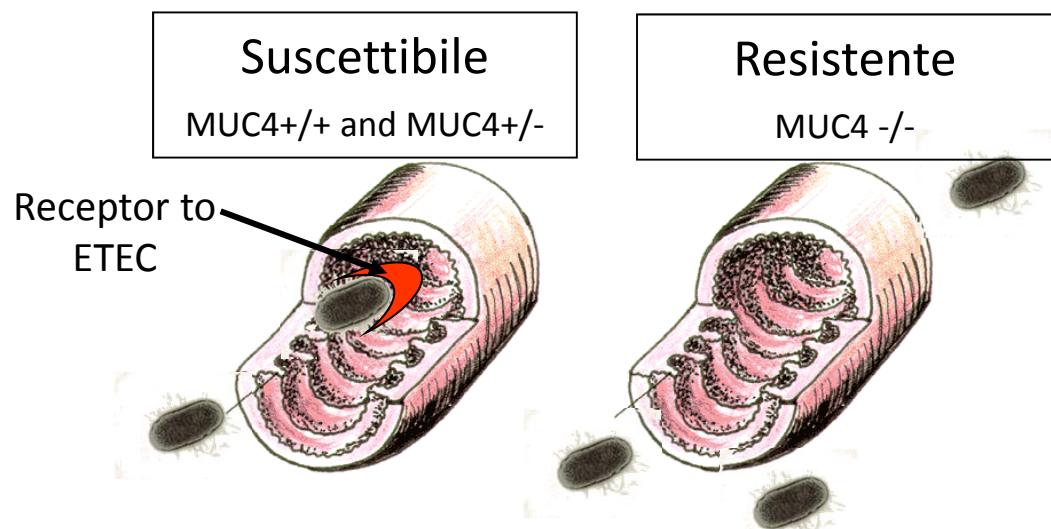
Può un singolo gene influenzare i fabbisogni alimentari del suino?

Il caso del gene Mucina 4 associato alla suscettibilità per E. coli F4ac

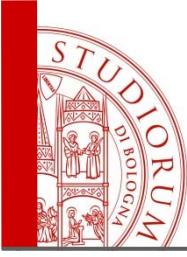


- La suscettibilità ad ETEC F4ac è associata con la presenza di mutazioni sul gene Mucina 4 (MUC4)
- È stato individuato un polimorfismo di tale gene utile come marcatore per la suscettibilità nel suino

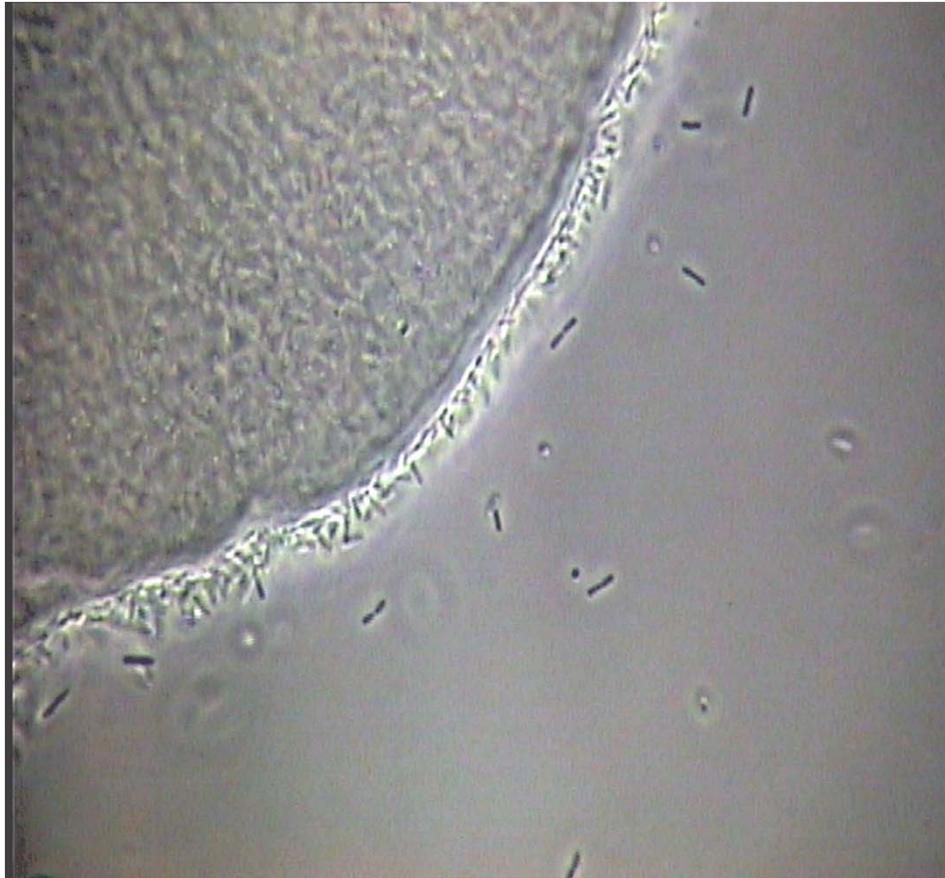
→ La mancanza dei recettori per F4ac è un carattere recessivo



- La suscettibilità per ETEC F18 è associata con la presenza di mutazioni a carico del gene FUT1



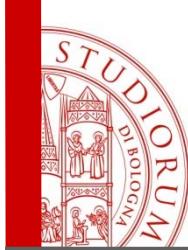
Recettori specifici per ETEC F4ac nell'intestino (fenotipo)



Suino suscettibile (F4 R⁺ classe 3)



Suino resistente (F4 R⁻ classe 0)



Frequenza allelica per il gene MUC4 in diverse razze

Fontanesi et al. 2012. Animal Biotechnology. 23,147-155

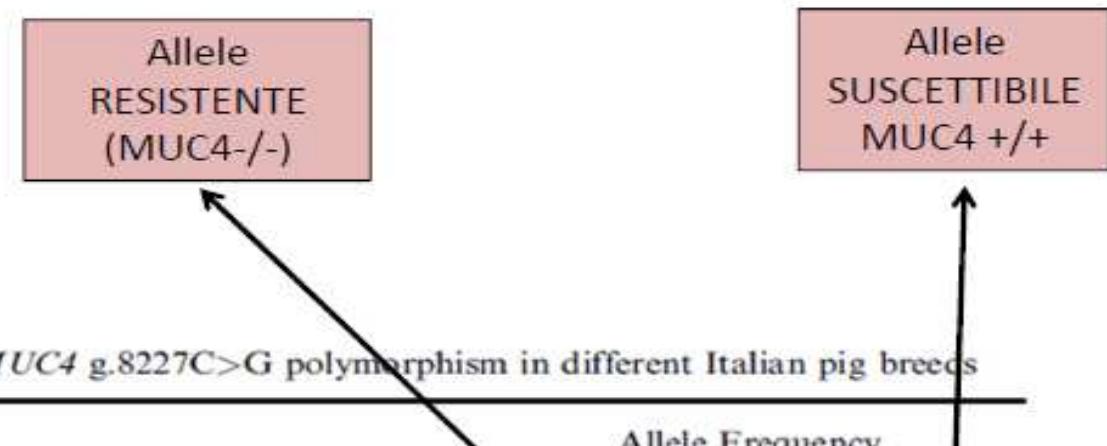
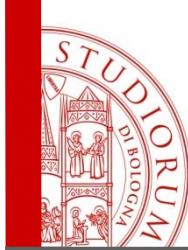


Table 2 Allele frequencies of the *MUC4* g.8227C>G polymorphism in different Italian pig breeds

Breed	No. of Pigs	Allele Frequency	
		C	G
Italian Large White ^a	541	0.507	0.493
Italian Landrace ^b	65	0.540	0.460
Italian Duroc ^b	48	0.917	0.083
Calabrese	15	0.830	0.170
Casertana	27	0.910	0.090
Cinta Senese	22	1.000	0.000
Nero Siciliano	30	0.720	0.280

^aTwo generation unrelated pigs of the selective genotyping study using backfat thickness estimated breeding value.

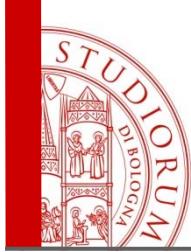
^bTwo generation unrelated pigs of the selective genotyping study using average daily gain estimated breeding value.



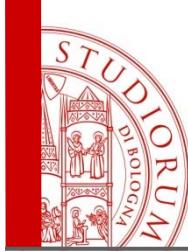
Calcolo degli aminoacidi più rappresentati in alcune proteine secrete nell'intestino legate alla risposta immunitaria

Proteins	The most represented AA ¹	Percentage of total AA number ¹
- Mucins		
MUC1 (more in the stomach)	Thr - Ser	17.4 - 15.5
MUC2 (Human)	Thr	17.5
MUC13 (more in jejunum)	Asn - Thr	8.5 - 5.6
MUC20 (more in colon)	Thr	15.5
- Immunoglobulins		
IgA constant chain	Thr	9.6
IgM constant chain (Human)	Thr	9.6
Joining chain of Multimeric IgA And IgM	Thr	9.1
- Defence and antibacterial, lectins		
Regenerating Family Member 3 Gamma (REG3G)	Ser	13.8
LY6/PLAUR Domain Containing 8 (LYPD8)	Thr - Ser	11.1 - 9.9
Lysozyme	Leu	10.1
Haptoglobin	Val	8.2
Alkaline phosphatase, intestinal	Arg / Leu	9.9 each

Composition obtained from the gene DNA sequence reported in Ensemble data base for pigs (or for human when the sequence was not available)



1. Effetto della Thr sulle performance di crescita, la salute intestinale e l'immunità in suini esposti ad ETEC, suscettibili e non



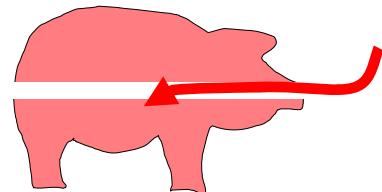
1. Salute intestinale e Treonina

Treonina - mucosa intestinale

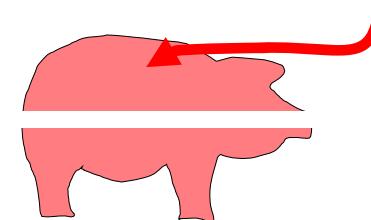
Threonine requirement when fed parenterally = 40-45% of the requirement when fed orally

7 (28-day-old) piglets (8 kg) implanted with catheters.

Orally fed piglets
Requirement = 100

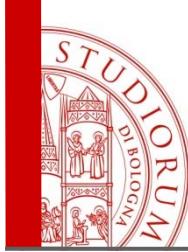


Parenterally fed
Requirement = 45 to 40



(Stoll *et al.*, 1998; Bertolo *et al.*, 1998; Burrin *et al.*, 2001 Ball *et al.*, 2000)

**60-50% della Thr ingerita, è utilizzata dalla mucosa intestinale
(mucosal cells)**

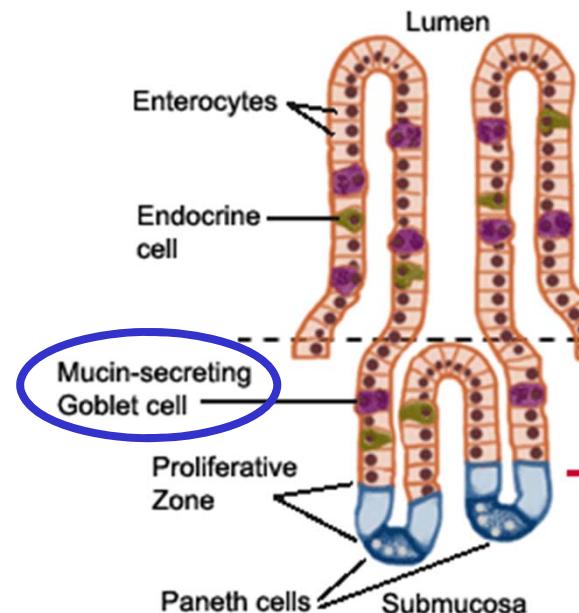
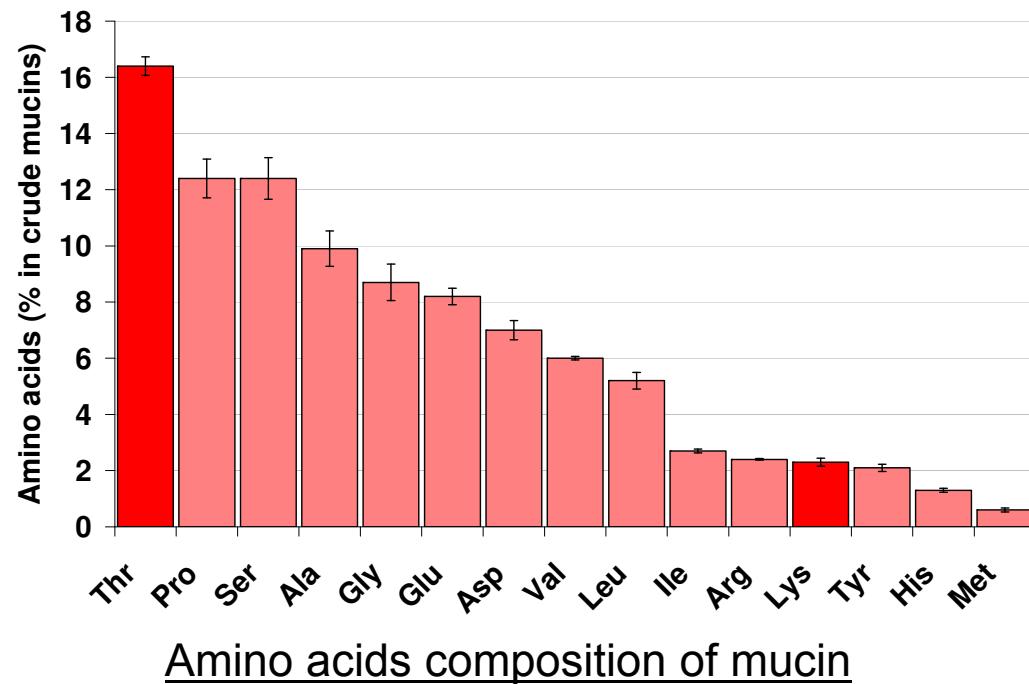


1. Produzione di Muco e mucine

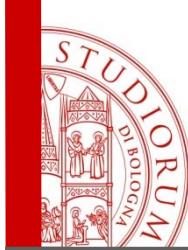
Azione protettiva del muco;

Mucine: proteine principali del muco;

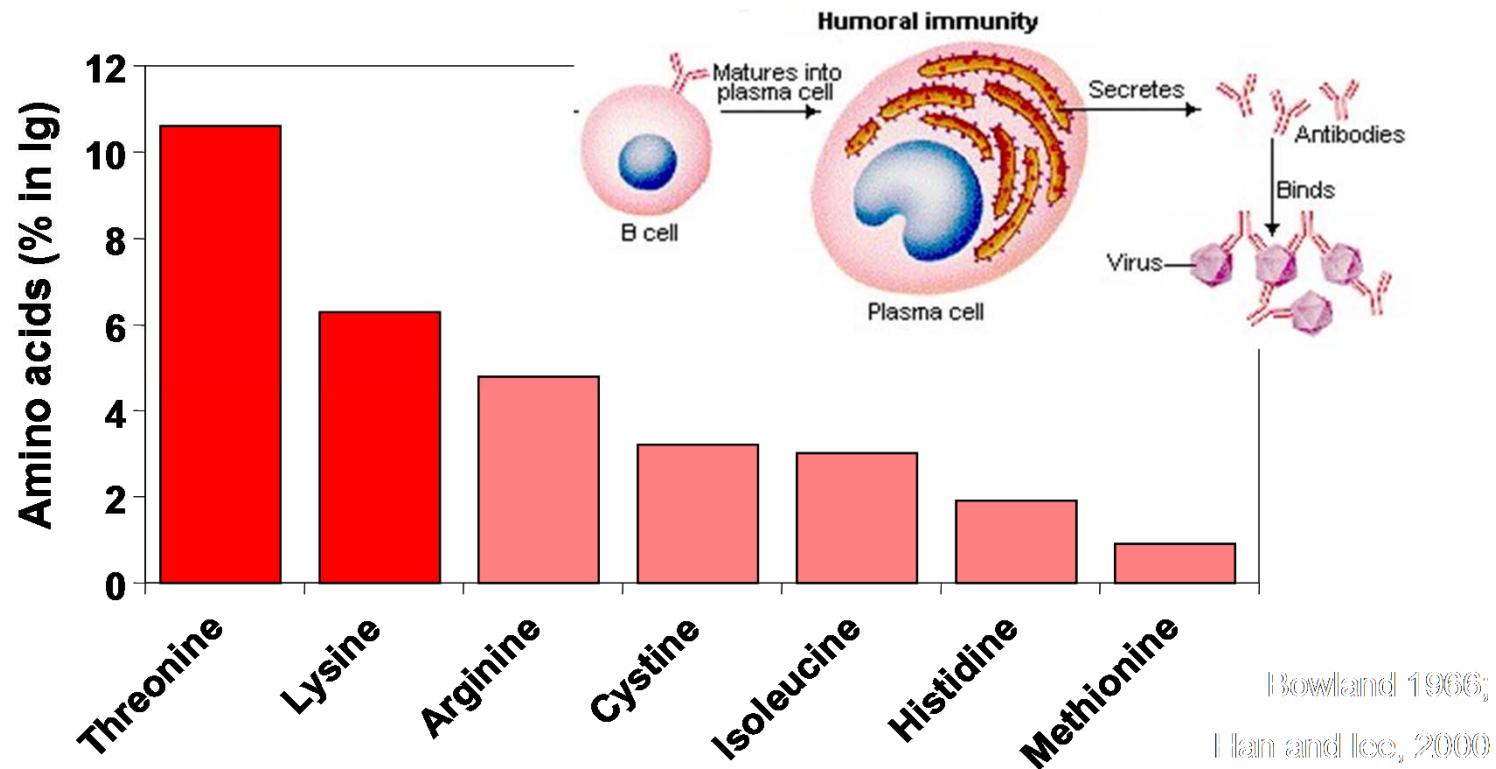
Thr è il 1st AA costituente le mucine che sono secrete dalle Goblet cells



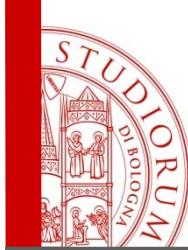
(Ball, 2002 from Lien et al., 1997)



1. Immunità umorale & profilo aminoacidico delle immunoglobuline



➡ Thr è il 1st AA essenziale nelle Ig



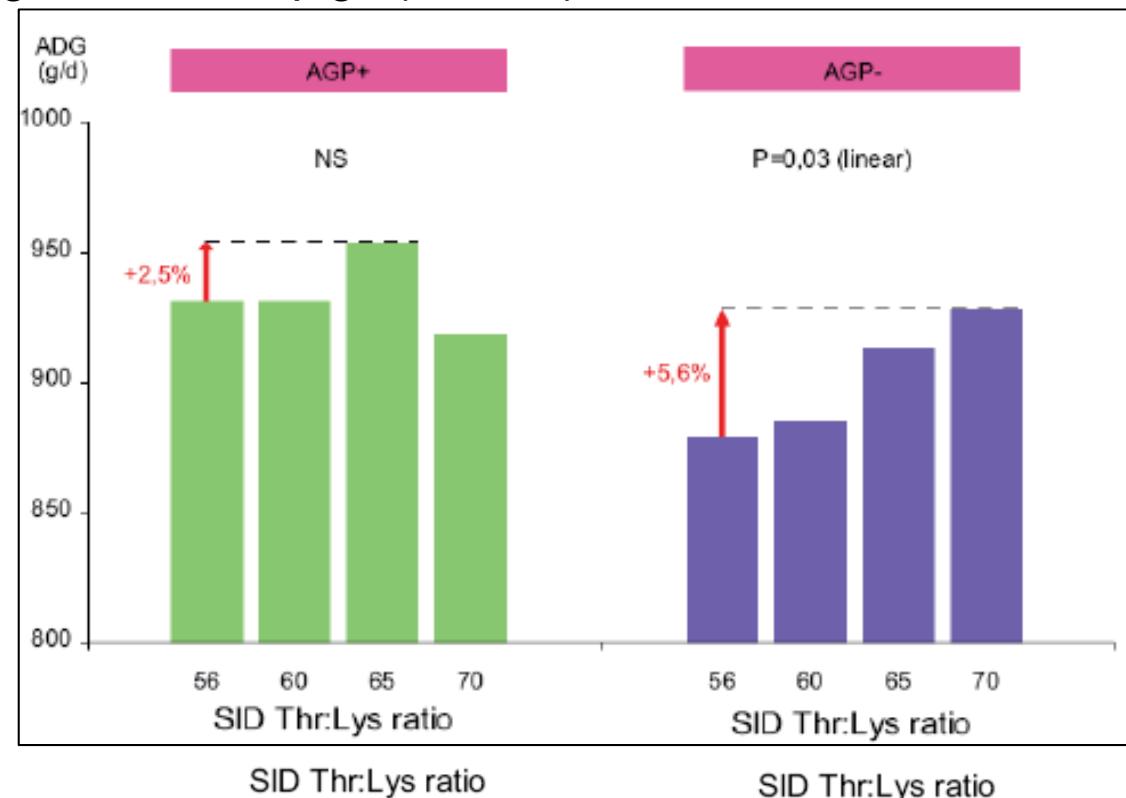
1. Impatto del divieto di APC (Salinomycin) sul fabbisogno in Thr in suini nella fase accrescimento-finissaggio

AGP significantly improved the growth of the pigs ($P<0.01$)

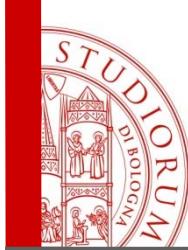
When the diet did not contain AGP, dietary Thr:

- ✓ linearly increased daily gain ($P=0.03$)
- ✓ quadratically decreased FCR ($P=0.03$)

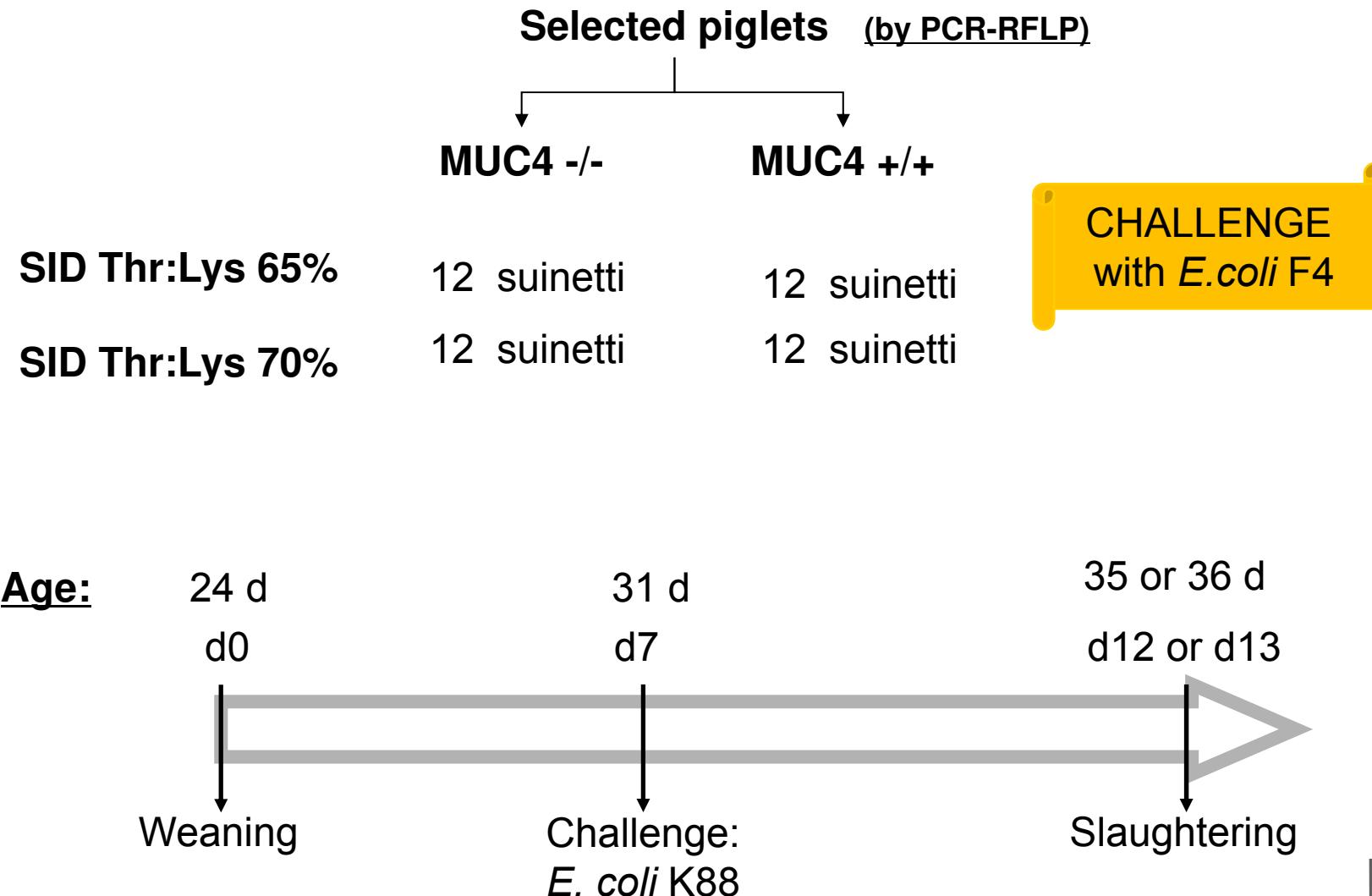
(Bikker et al., 2006)

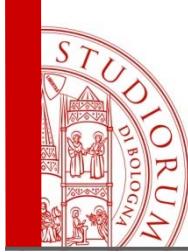


Il divieto di APC aumenta il fabbisogno di Thr

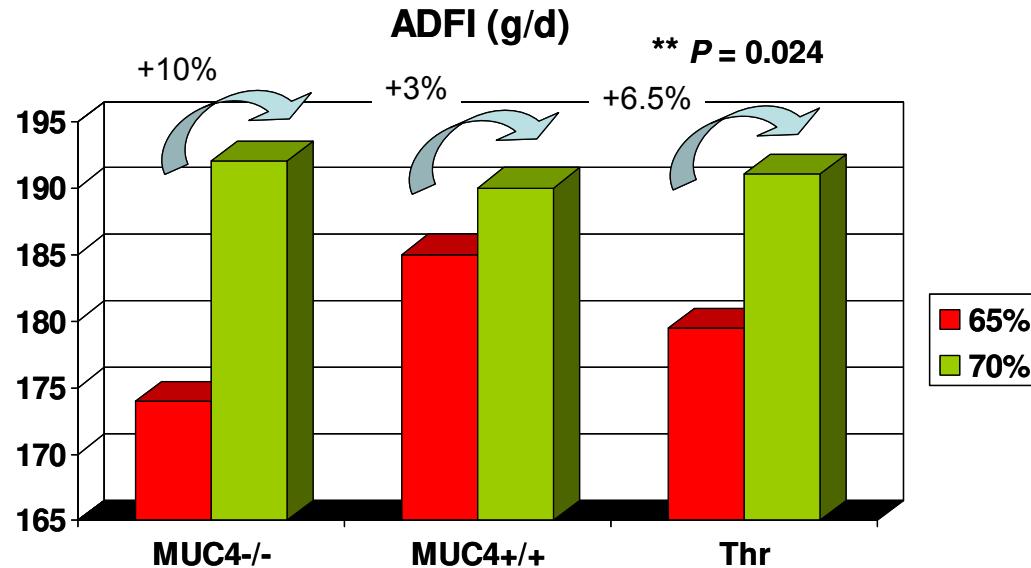


1. Disegno sperimentale





1 Performance di crescita - ingestione

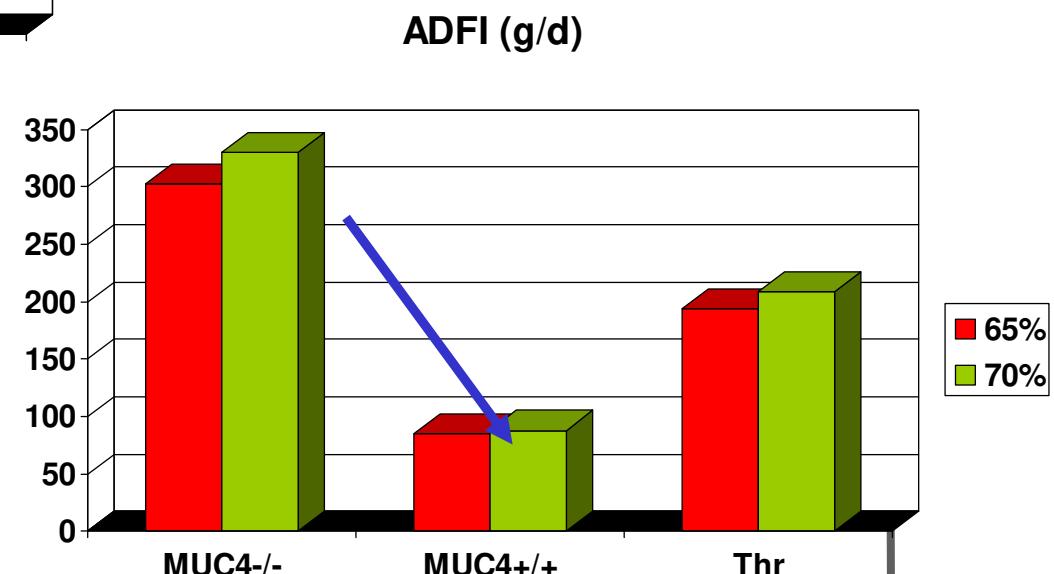


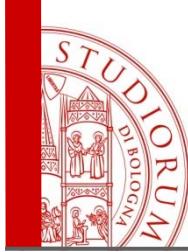
Prima dell'infezione:

Thr aumenta l'ingestione ($p<0.05$)

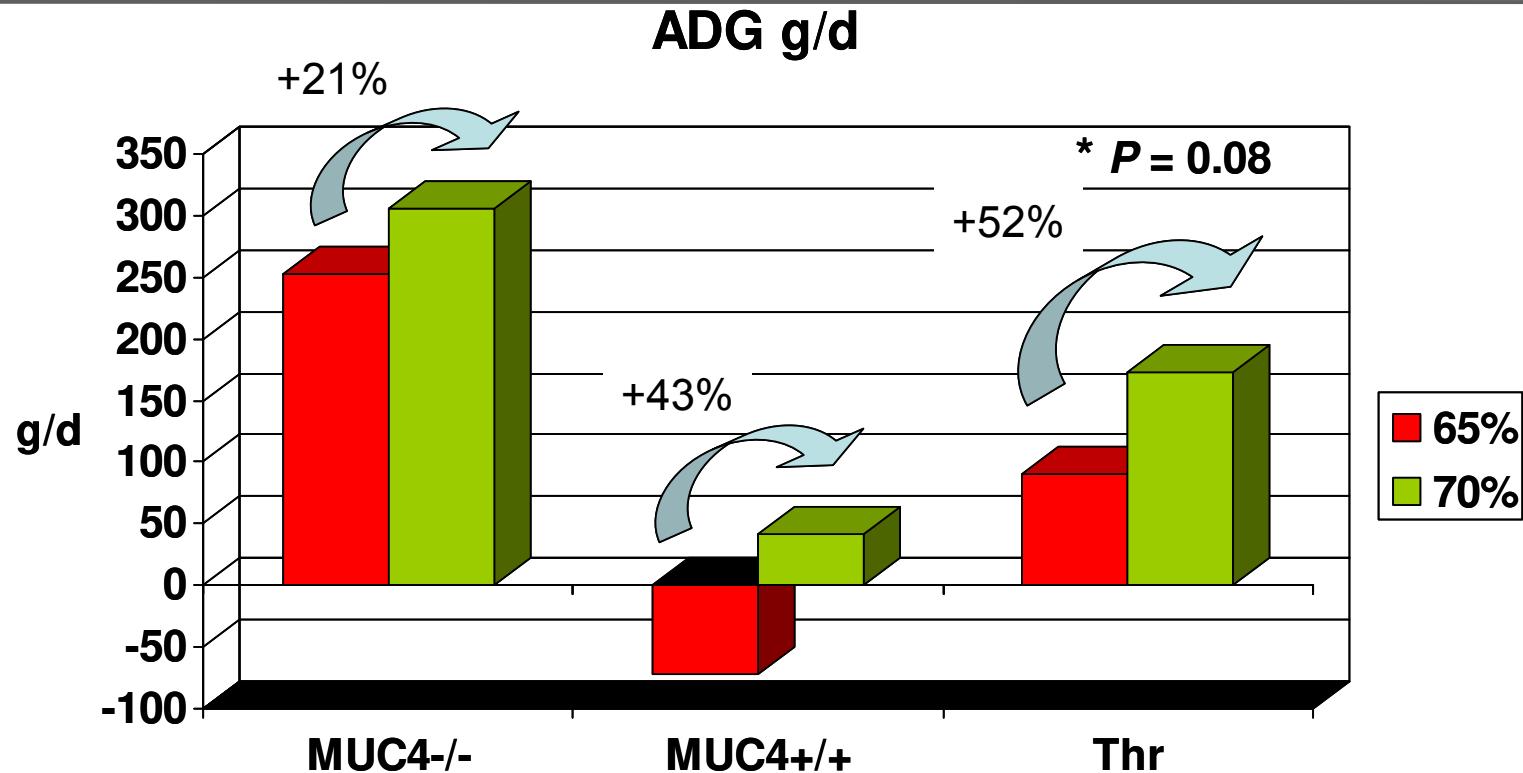
Dopo l'infezione:

Thr non previene la riduzione
dell'ingestione nei soggetti
susceptibili

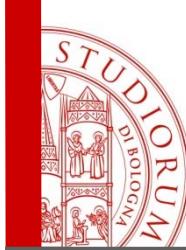




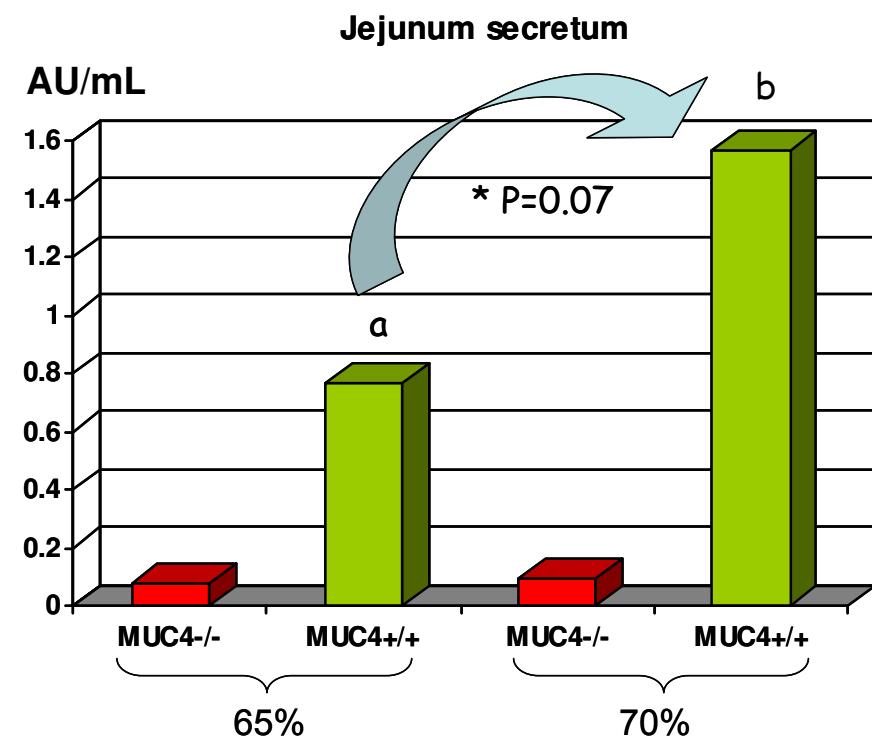
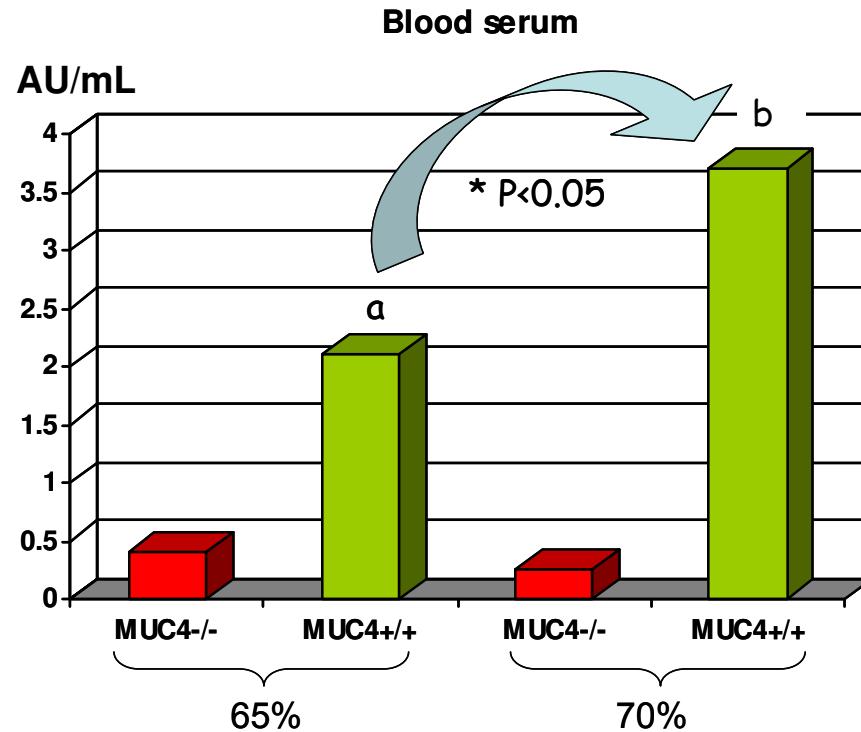
1. Performance di crescita - IPG



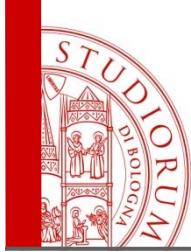
- I suinetti suscettibili sono più sensibili alla carenza in Thr:Lys ratio
- In generale, maggiore Thr tende a favorire la crescita (p=0.08)



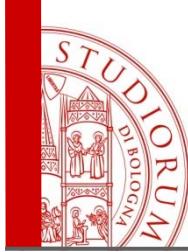
1. Immunità - IgA specifiche verso ETEC F4



Più Thr aumenta la concentrazione di **anti F4-IgA** nel sangue ($p<0.05$) e nel digiuno ($p=0.08$) nei suini suscettibili

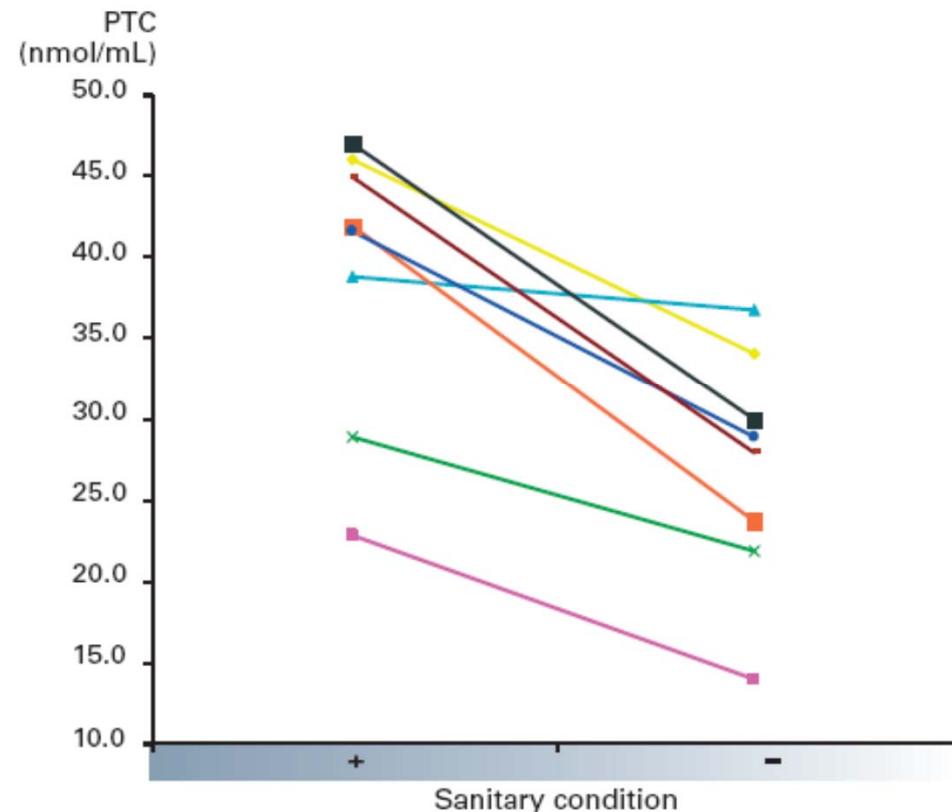


2. Effetto del Trp sulle performance di crescita di suini suscettibili o resistenti ad ETEC, in animali sani

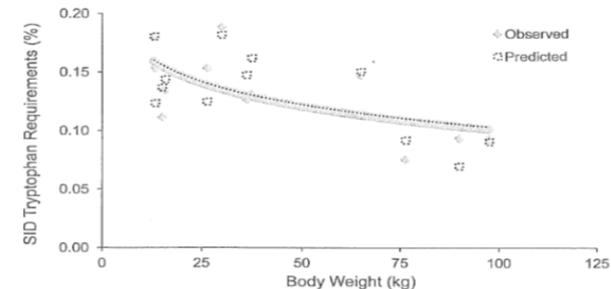


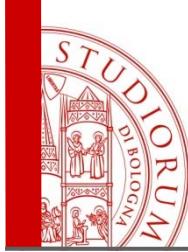
2. Triptofano e immunità

↓ Trp nel sangue in condizioni sanitarie non ottimali
(adattato da Corrent&Simongiovanni)

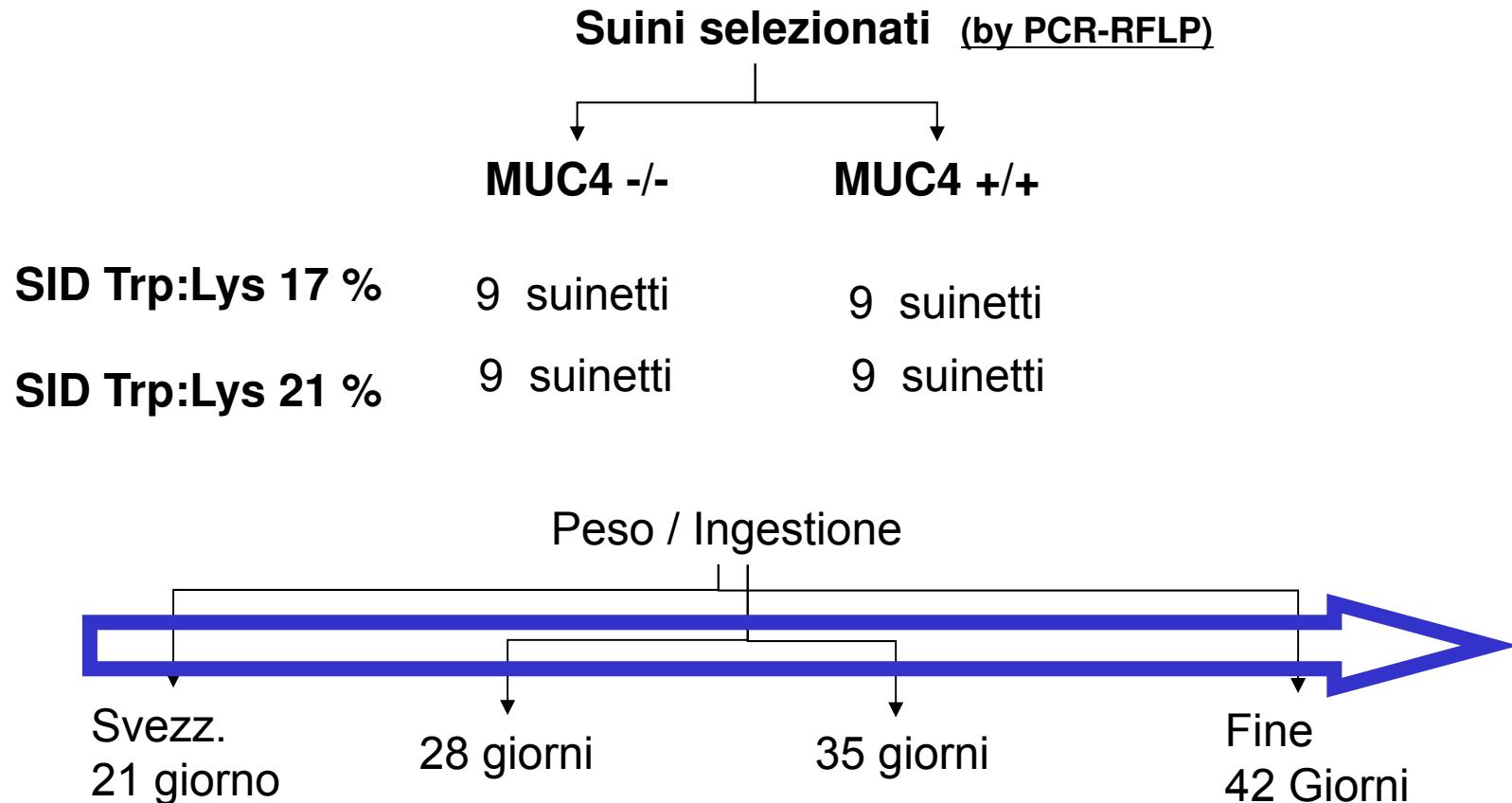


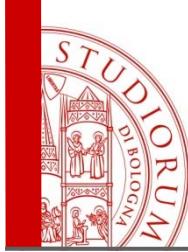
L'infiammazione
stimola il
catabolismo del
TRP



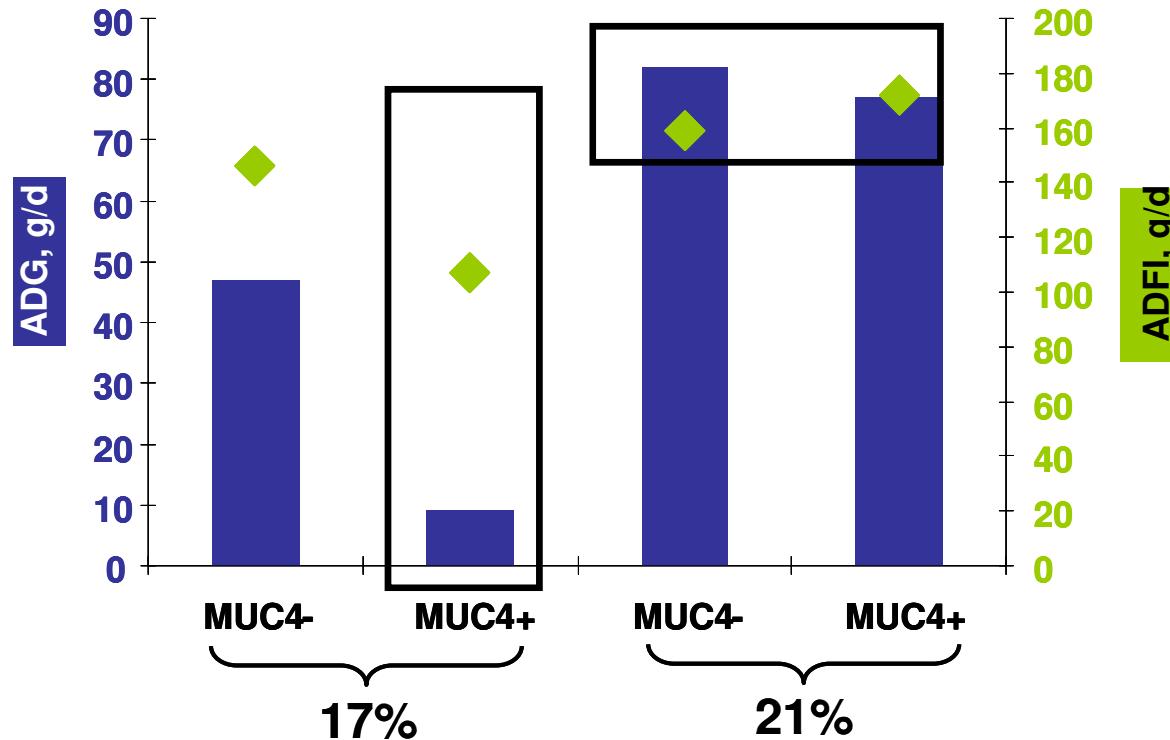


2. Disegno sperimentale

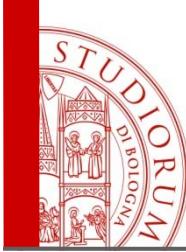




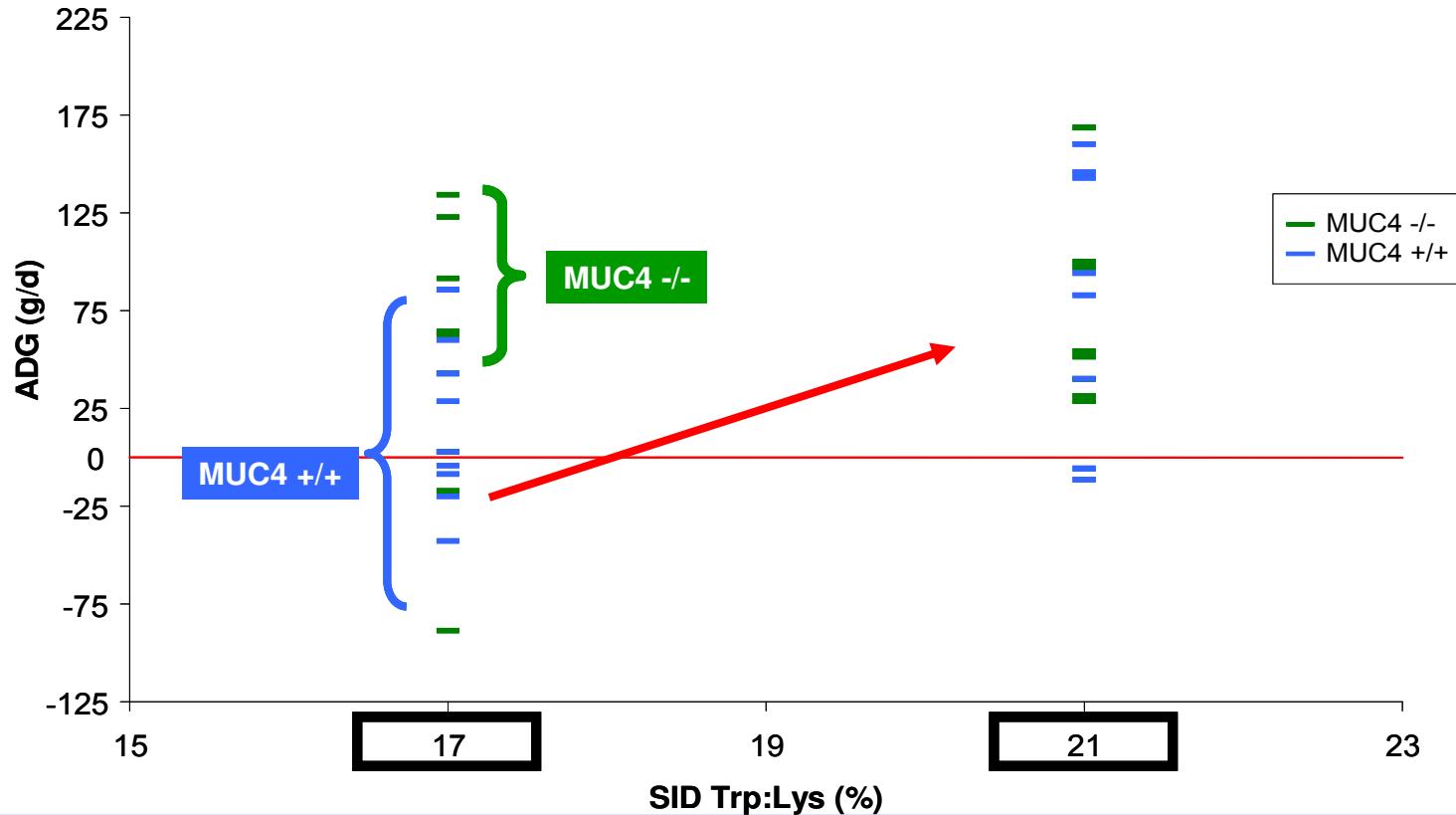
2. Prima settimana (giorni 21 - 28 di vita)



- 1) Animali suscettibili (MUC4+) sono più sensibili alla carenza di Trp
→ Minore ingestione ($p<0.01$) e IPG
- 2) Un SID Trp:Lys ratio @ 21% allevia queste differenze :
→ Migliore ingestione ($p<0.05$) e IPG ($p<0.05$)

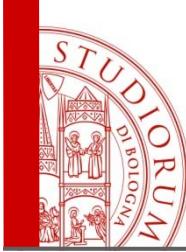


2. IPG individuale da 21 a 28 giorni di età

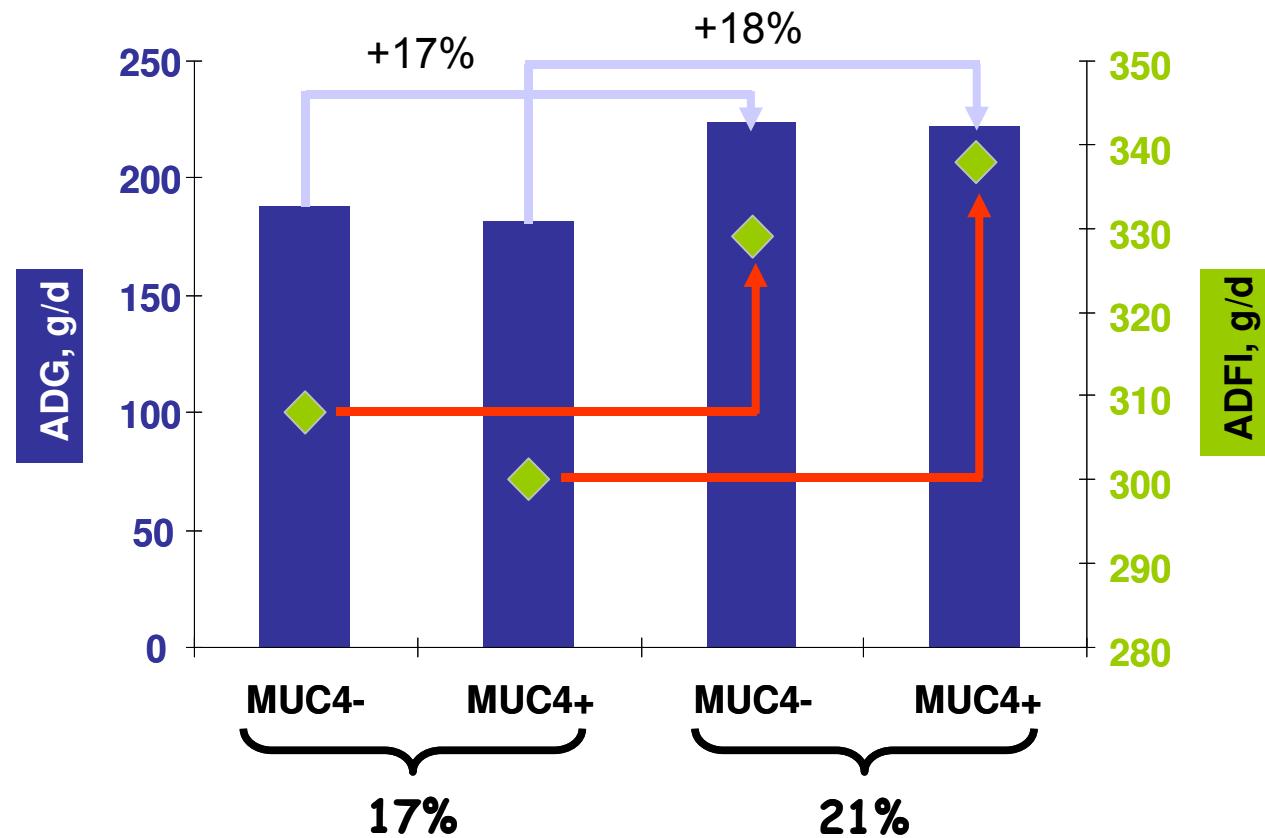


SID Trp:Lys ratio @ 21%:

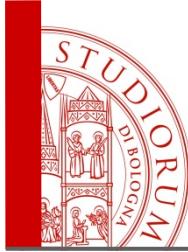
- Migliore IPG
- Riduce le differenze individuali tra suinetti MUC4^{+/+} e MUC4^{-/-}



2. Da 21 a 42 giorni di età



- SID Trp:Lys ratio @ 21% aumenta IPG($p<0.05$) e ingestione
- No interazione con il genotipo



Veterinary Microbiology 162 (2013) 173–179



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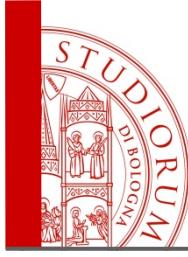
journal homepage: www.elsevier.com/locate/vetmic



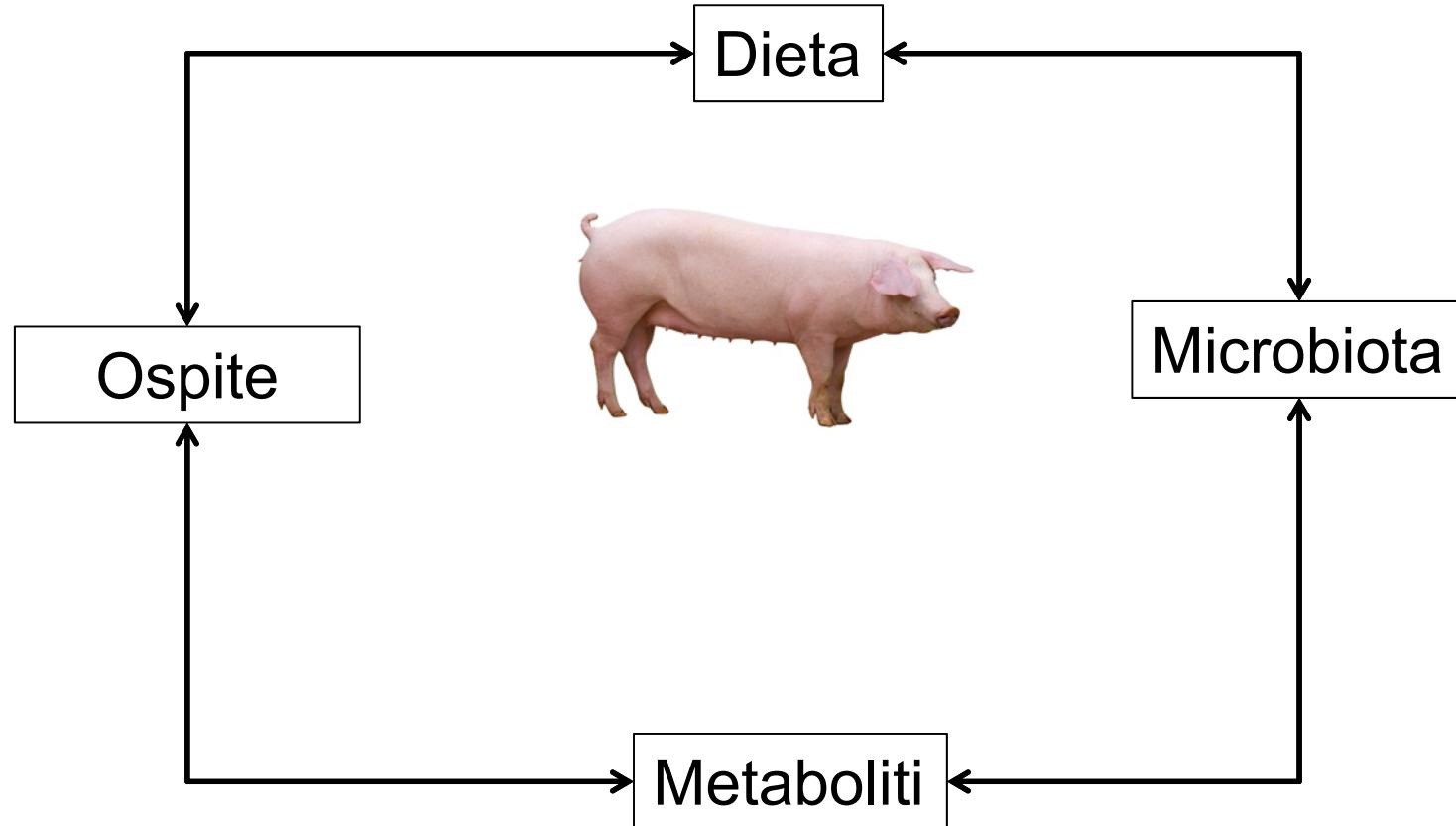
Effect of susceptibility to enterotoxigenic *Escherichia coli* F4 and of dietary tryptophan on gut microbiota diversity observed in healthy young pigs

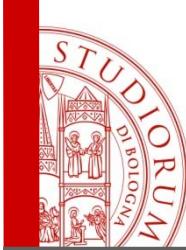
Stefano Messori ^{a,1}, Paolo Trevisi ^{a,1}, Aude Simongiovanni ^b, Davide Priori ^a, Paolo Bosi ^{a,*}

Maggiore DNA associato a *Clostridium bartletti* in suini
scarsamente suscettibili ad ETEC F4 ed alimentati
con maggiore Trp:Lys ratio



Ambiente vs Microbiota





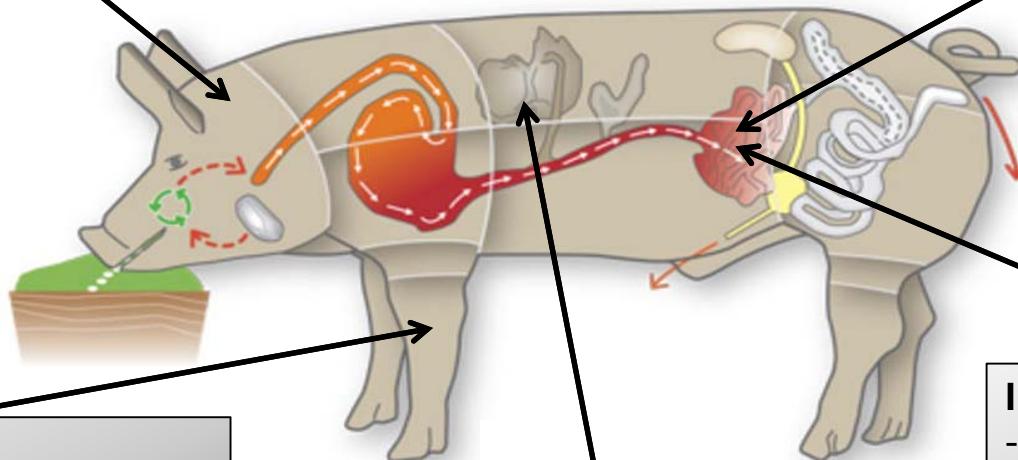
Ruolo del microbiota sulla fisiologia dell'ospite

Behavior

- Decreasing synaptic connectivity
- Promoting anxiety-like behavior and pain perception

Metabolism

- facilitate energy harvest from the diet
- Promote host adiposity



Bone homeostasis

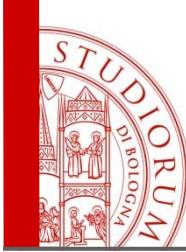
- Decreasing bone mass by promoting the function of osteoclasts and increasing the numbers of pro-inflammatory Th17 cells.

Intestinal vessels formation

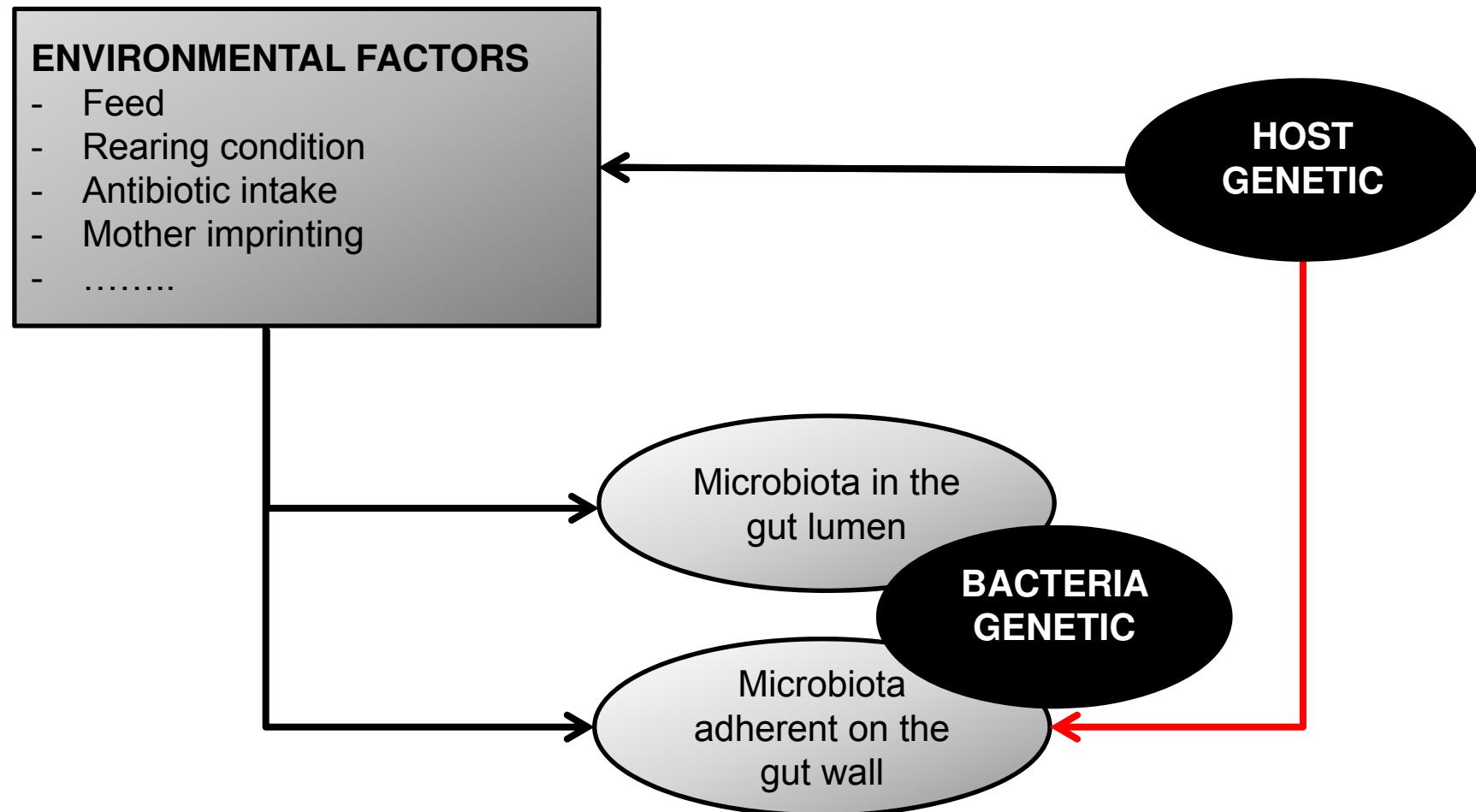
Activation of Tissue Factor pathway that influence vascular remodelling in the small intestine

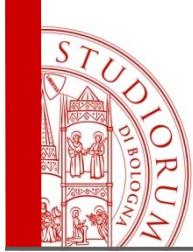
Intestinal function

- Gut-associated lymphoid tissue (GALT) maturation,
- Tissue regeneration
- Motility
- Barrier integrity

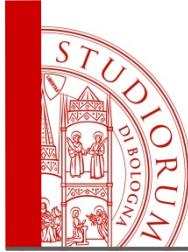


Fattori che influenzano la composizione/colonizzazione del microbiota intestinale



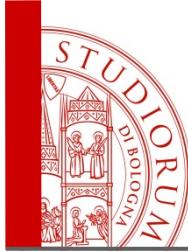


Esiste il microbiota ottimale per favorire la salute del suino?



Conclusioni

- È necessario comprendere il concetto di continuità per definire migliori strategie di allevamento volte a garantire lo sviluppo fisiologico del suinetto.
- I fabbisogni alimentari dei suini sono obsoleti e studiati in condizioni non paragonabili a quelle odierne.
- La questione “antibiotico” deve essere un’opportunità per rivedere gli aspetti di base della zootecnia.
- Non esistono scorciatoie per ridurre l’uso di antibiotici nel sistema zootecnico italiano, serve un approccio integrato



The antibiotic issue, can affect the consumer decision making or is the contrary?

BEUC The European Consumer Organisation
The Consumer Voice in Europe

**Antibiotic use in livestock:
Time to act**

BEUC Position Paper

Contact: Pauline Castres – food@beuc.eu

Ref.: BEUC-X-2014-043 - 11/06/2014

Version updated on 04/08/2014: annex added

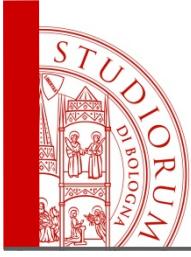
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Take home message

Foto del 15.09.2015 – SPACE, Francia





Grazie per l'attenzione

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