**Luca Fontanesi**

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http://www.unibo.it/sitoweb/luca.fontanesi

# Bologna (The town)


ALMA MATER STUDIORUM A.D. 1088

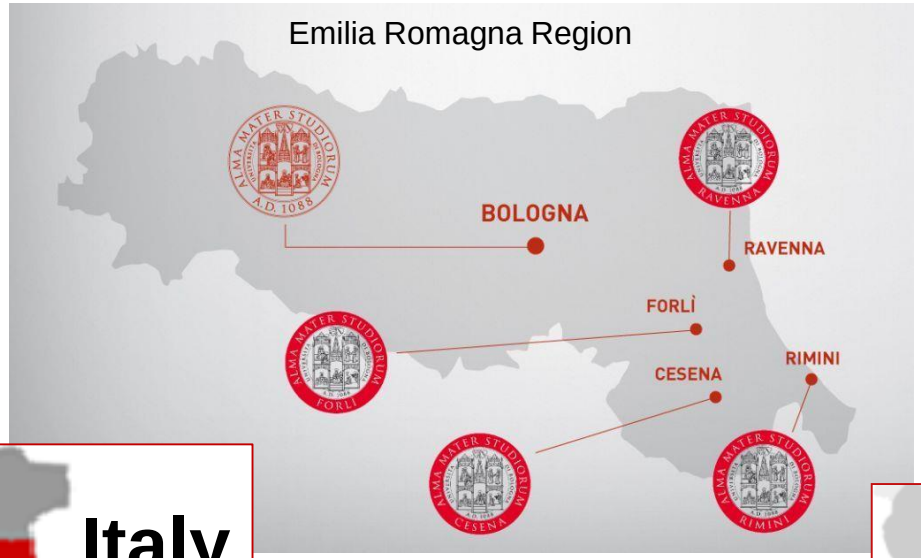
# UNIVERSITÀ DI BOLOGNA

# A MULTIDISCIPLINARY RESEARCH UNIVERSITY

**About 90,000 students**

**2,847 teaching staff**
**734 professors**
**829 associate professors**
**1,284 researchers**

# ALMA MATER STUDIOURUM – University of Bologna (Multi Campus University)





# ALMA MATER STUDIOURUM – University of Bologna
# (Multi Campus University)



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ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

DIPARTIMENTO

# SCIENZE E TECNOLOGIE AGRO-ALIMENTARI - DISTAL

Area Riservata | Biblioteche | Contatti

## Home

**Dipartimento**
La storia, l'organizzazione, le persone, gli organi

**Ricerca**
Gli ambiti, le pubblicazioni, i progetti, le attività

**Didattica**
Lauree e Lauree magistrali, i dottorati e gli altri corsi

**Centri e Laboratori**

## Dipartimento di Scienze e Tecnologie Agro-Alimentari

L'organizzazione, le persone, l'amministrazione e le strutture che compongono il Dipartimento di Scienze e Tecnologie Agro-Alimentari (DISTAL)

## In evidenza

on focus

**Ambiti di ricerca**
Le 7 aree tematiche principali dell'attività di ricerca del DISTAL.

## Avvisi

Bando assegno di ricerca prot. 389 - scad. presentazione domande 23/03/2015 ore 12:00 a Bologna- tutor Prof. Luca Fontanesi
Pubblicato il 10 marzo 2015

Bando assegno di ricerca prot. 326 - scad. presentazione domande 16/03/2015 ore 12:00- tutor Prof. Marco Dalla Rosa
Pubblicato il 26 febbraio 2015

Proposta di scambio contestuale di docenti tra due sedi Universitarie
Pubblicato il 2 dicembre 2014

Vedi tutto

## Eventi

20 aprile 2015
Climate Change and Coastal adaptation day

venerdì 20 marzo 20

# Genetic factors affecting dry-cured ham quality traits – the case of Italian heavy pigs

**Luca Fontanesi**

Department of Agricultural and Food Sciences (DISTAL)
Division of Animal Sciences
University of Bologna
Bologna, Italy

# Italian PDO products from pig meat

AGRICULTURE AND RURAL DEVELOPMENT

DOOR

European Commission > Agriculture and Rural Development > Agriculture and food > DOOR > Browse

- Latest registered designations
- Latest published designations
- Latest applied designations

| | |
|---|---|
| IT/PDO/0105/02118 | Crudo di Cuneo |
| IT/PDO/0117/02104 | Prosciutto Veneto Berico-Euganeo |
| IT/PDO/0005/0490 | Crudo di Cuneo |
| IT/PDO/0117/0067 | Prosciutto di Parma |
| IT/PDO/0005/0145 | Soprèssa Vicentina |
| IT/PDO/0017/1301 | Salamini italiani alla cacciatora |
| IT/PDO/0017/1567 | Pancetta di Calabria |
| IT/PDO/0017/1568 | Salsiccia di Calabria |
| IT/PDO/0017/1569 | Soppressata di Calabria |
| IT/PDO/0017/1570 | Capocollo di Calabria |
| IT/PDO/0017/1492 | Culatello di Zibello |
| IT/PDO/0017/1493 | Valle d'Aosta Lard d'Arnad/Vallée d'Aoste Lard d'Arnad |
| IT/PDO/0017/1494 | Prosciutto Toscano |
| IT/PDO/0017/1495 | Valle d'Aosta Jambon de Bosses |
| IT/PDO/0017/1496 | Prosciutto di Carpegna |
| IT/PDO/0017/1497 | Pancetta Piacentina |
| IT/PDO/0017/1498 | Coppa Piacentina |
| IT/PDO/0017/1499 | Salame Piacentino |
| IT/PDO/0017/0065 | Prosciutto di San Daniele |
| IT/PDO/0017/0066 | Prosciutto di Modena |
| IT/PDO/0017/0068 | Prosciutto Veneto Berico-Euganeo |
| IT/PDO/0017/0208 | Salame di Varzi |
| IT/PDO/0017/0326 | Salame Brianza |

2 billion of euro per year

# Italian heavy pig breeds

Italian Large White

Italian Duroc

Italian Landrace

Selection programs in heavy pigs are complicated as they should satisfy expectation of

Farmers

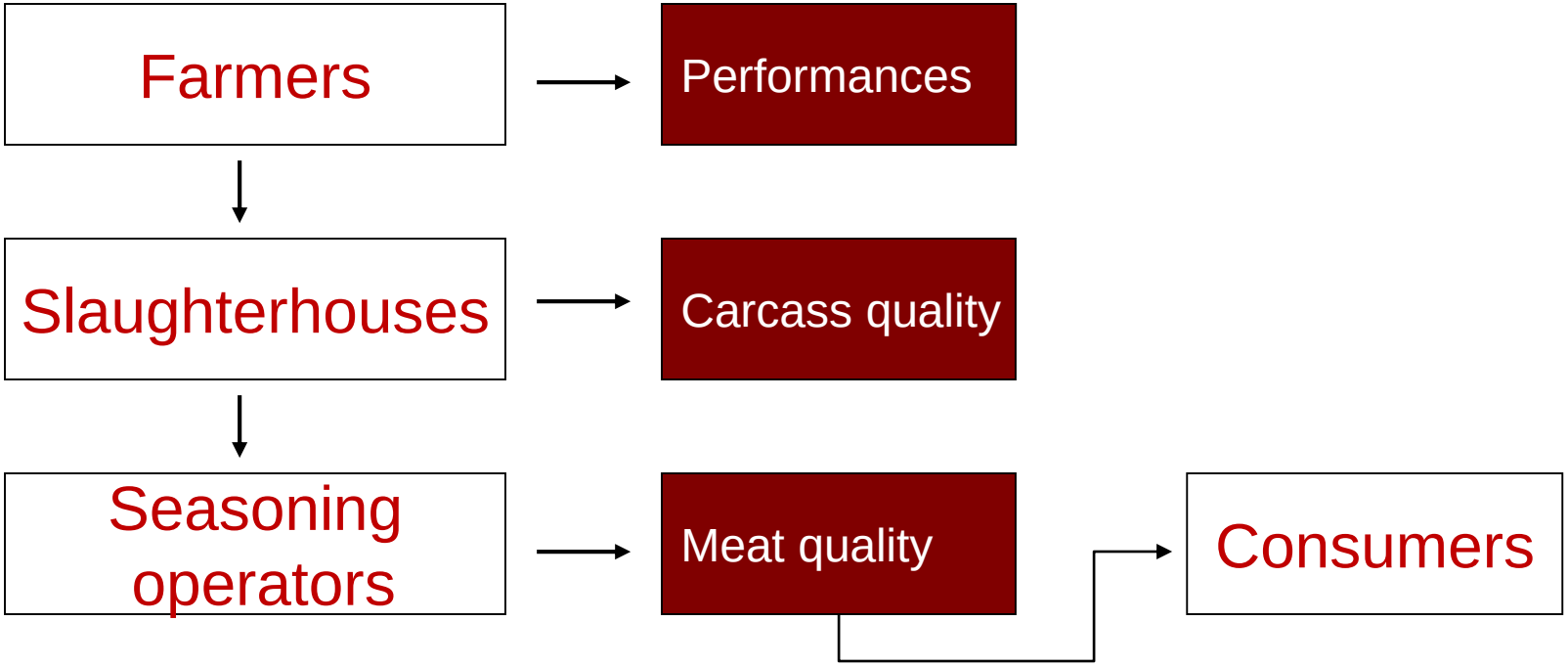
↓

Slaughterhouses

↓

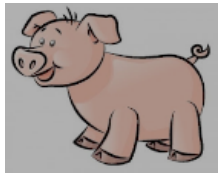
Seasoning operators

# Selection programs in heavy pigs are complicated as they should satisfy expectation of



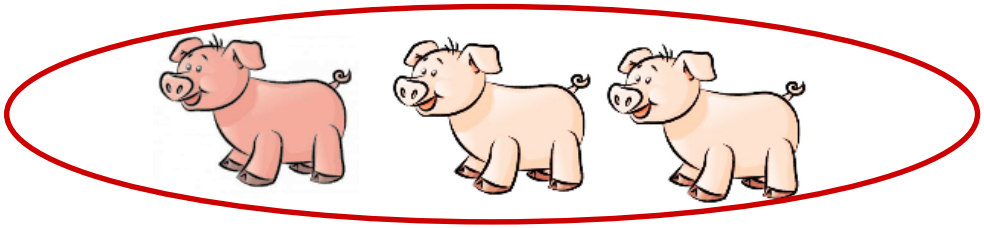
# Sib-test

Candidate boar in the farm



Performance tested pigs at the genetic station

3 full sibs (1 catrated male and 2 females)



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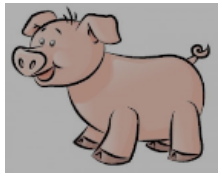

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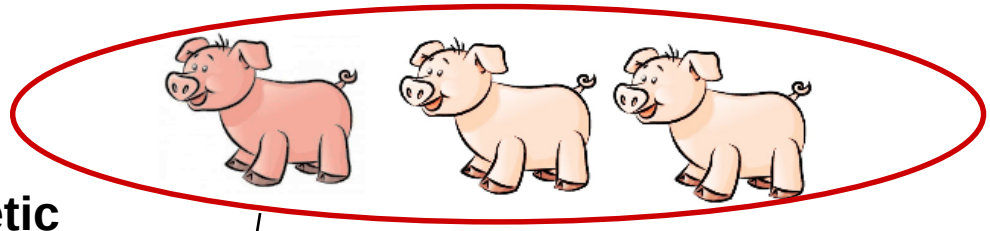
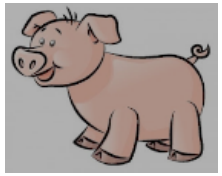


**At the genetic station**

Average daily gain (g)
Feed convertion rate

# Sib-test

Candidate boar in the farm



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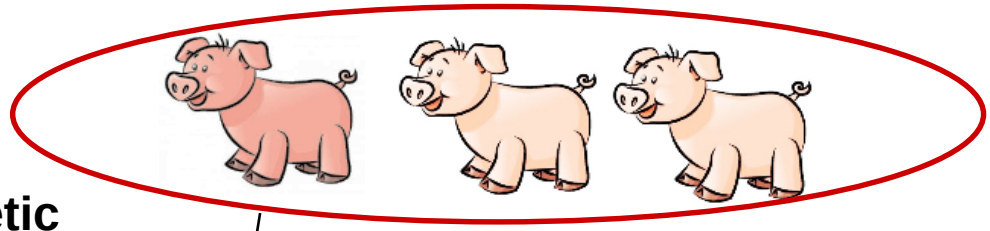


**At the genetic station**

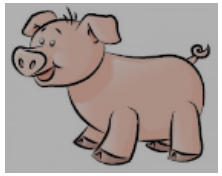
Average daily gain (g)
Feed convertion rate

**At slaughterhouse (155 kg)**

Back fat thickness (mm)
Lean cuts (neck and loin) weight (kg)
Ham weight (kg)
Visible intermuscular fat

# Sib-test

Candidate boar in the farm



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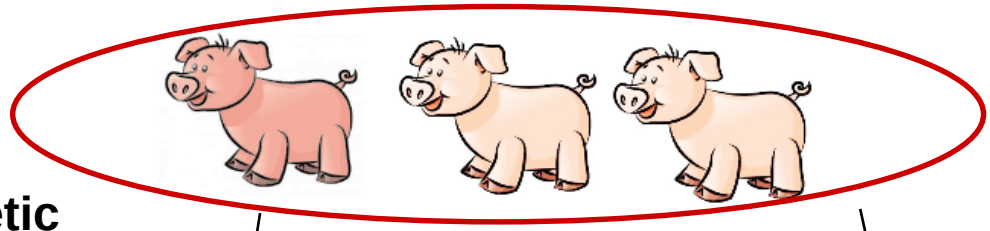

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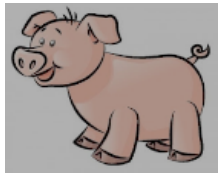
**At the seasoning plant**

Ham weight loss at first salting (g)

# Sib-test

Candidate boar in the farm



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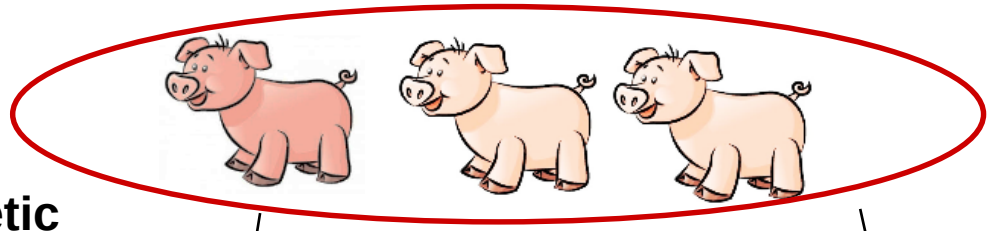

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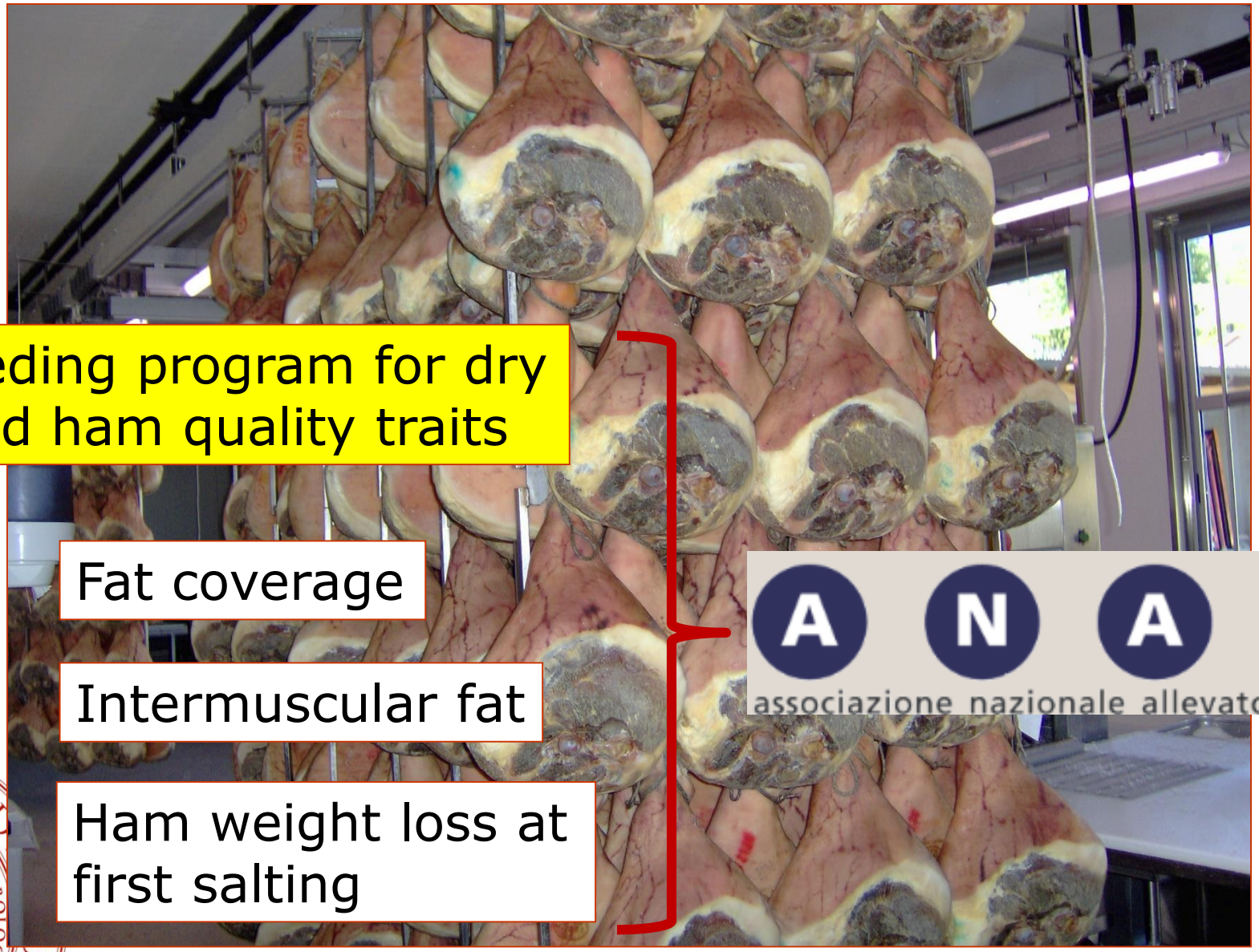
**At the seasoning plant**

Ham weight loss at first salting (g)

EBV: BLUP-Animal Model Multitrait



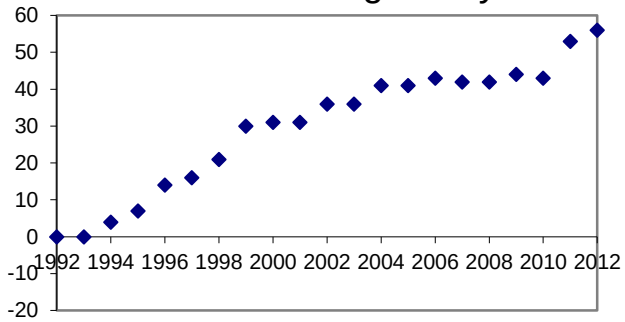
# Breeding program for dry cured ham quality traits

- Fat coverage
- Intermuscular fat
- Ham weight loss at first salting

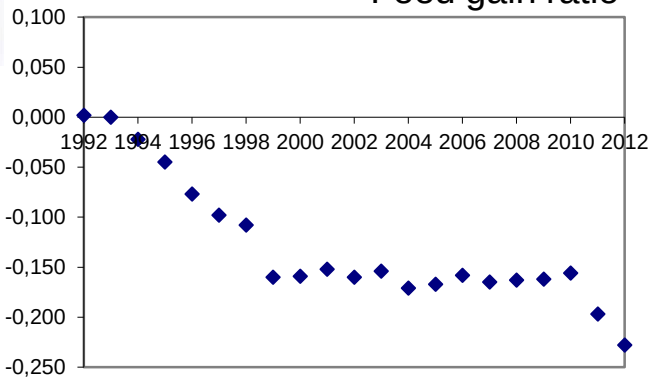
ANAS
associazione nazionale allevatori suini

# Italian Large White: genetic trends

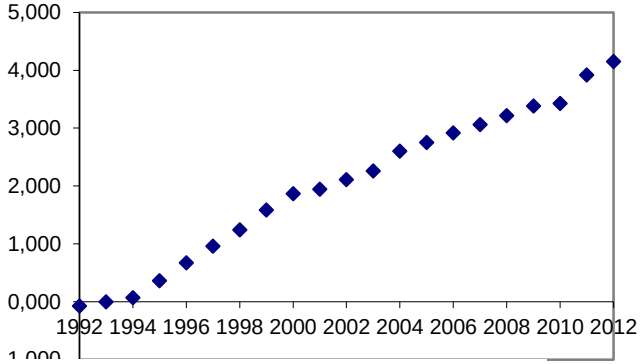
## Average Daily Gain



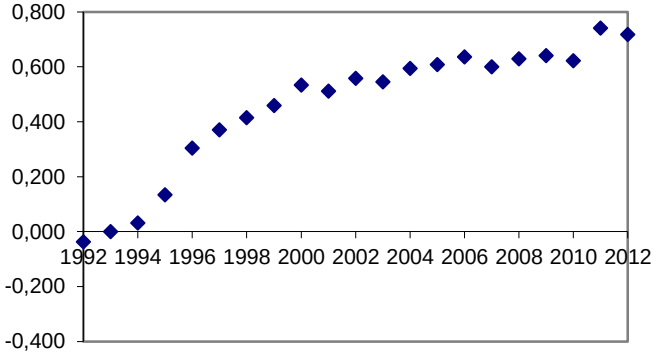

## Feed gain ratio



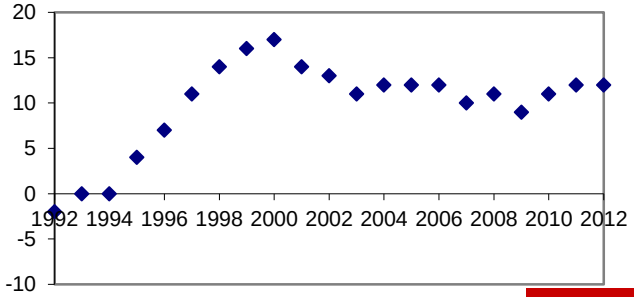

## Lean cuts



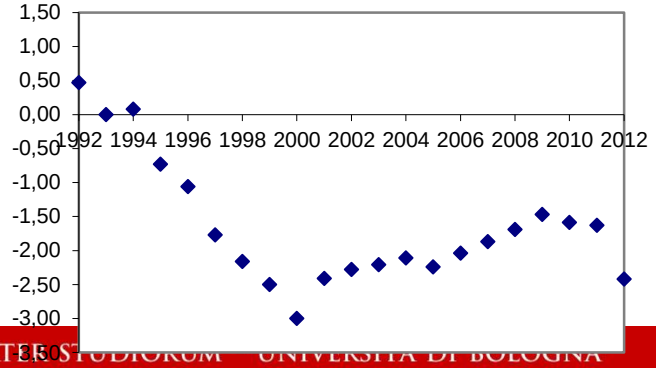

## Ham weight



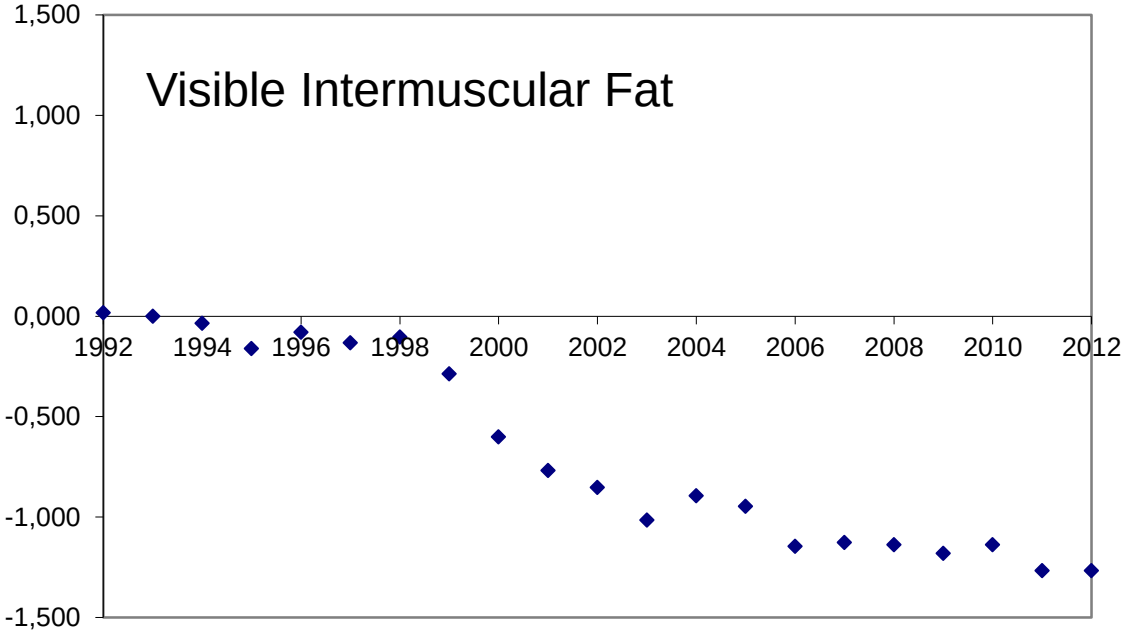

## Ham weight loss at first salting




## Back fat thickness



# Italian Duroc: genetic trend for VIF



# Heritability (diagonal) and genetic correlations between traits

| ILW | ADG | BFT | LC | HWLFS |
|---|---|---|---|---|
| ADG | 0.26 | | | |
| BFT | -0.02 | 0.61 | | |
| LC | 0.57 | -0.59 | 0.61 | |
| HWLFS | 0.17 | -0.78 | 0.69 | 0.57 |

| IL | ADG | BFT | LC | HWLFS |
|---|---|---|---|---|
| ADG | 0.44 | | | |
| BFT | -0.10 | 0.61 | | |
| LC | 0.62 | -0.64 | 0.70 | |
| HWLFS | 0.29 | -0.67 | 0.70 | 0.46 |

| ID | BFT | LC | HWLFS | VIF |
|---|---|---|---|---|
| BFT | 0.55 | | | |
| LC | -0.45 | 0.53 | | |
| HWLFS | -0.71 | 0.60 | 0.44 | |
| VIF | 0.42 | -0.16 | -0.66 | 0.38 |

ADG = Average Daily Gain
BFT = Back Fat Thickness
LC = Lean Cuts
HWLFS = Ham Weight Loss at First Salting
VIF = Visible Intermuscular Fat

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ADG = Average Daily Gain
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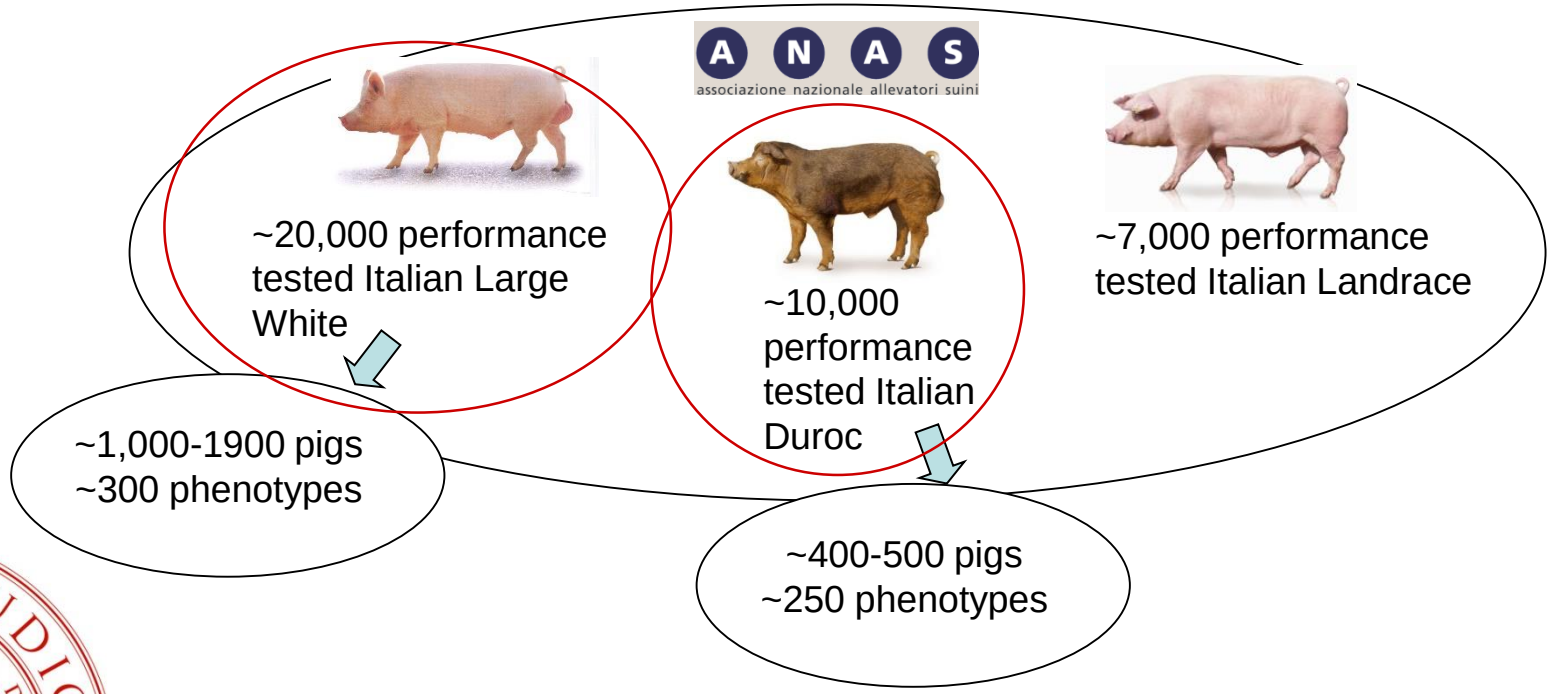
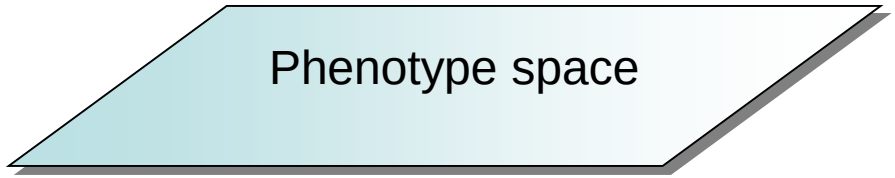
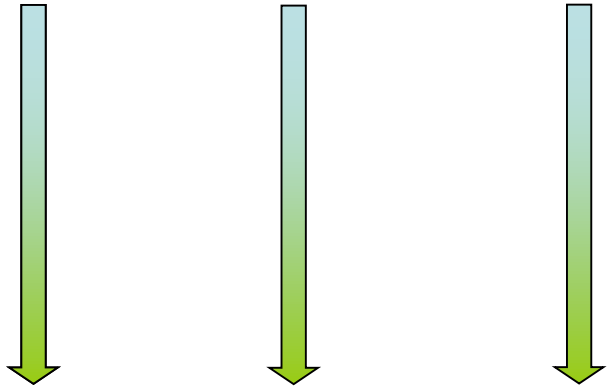
# Animal resources



# Genome Wide Association Studies



PorcineSNP60 BeadChip

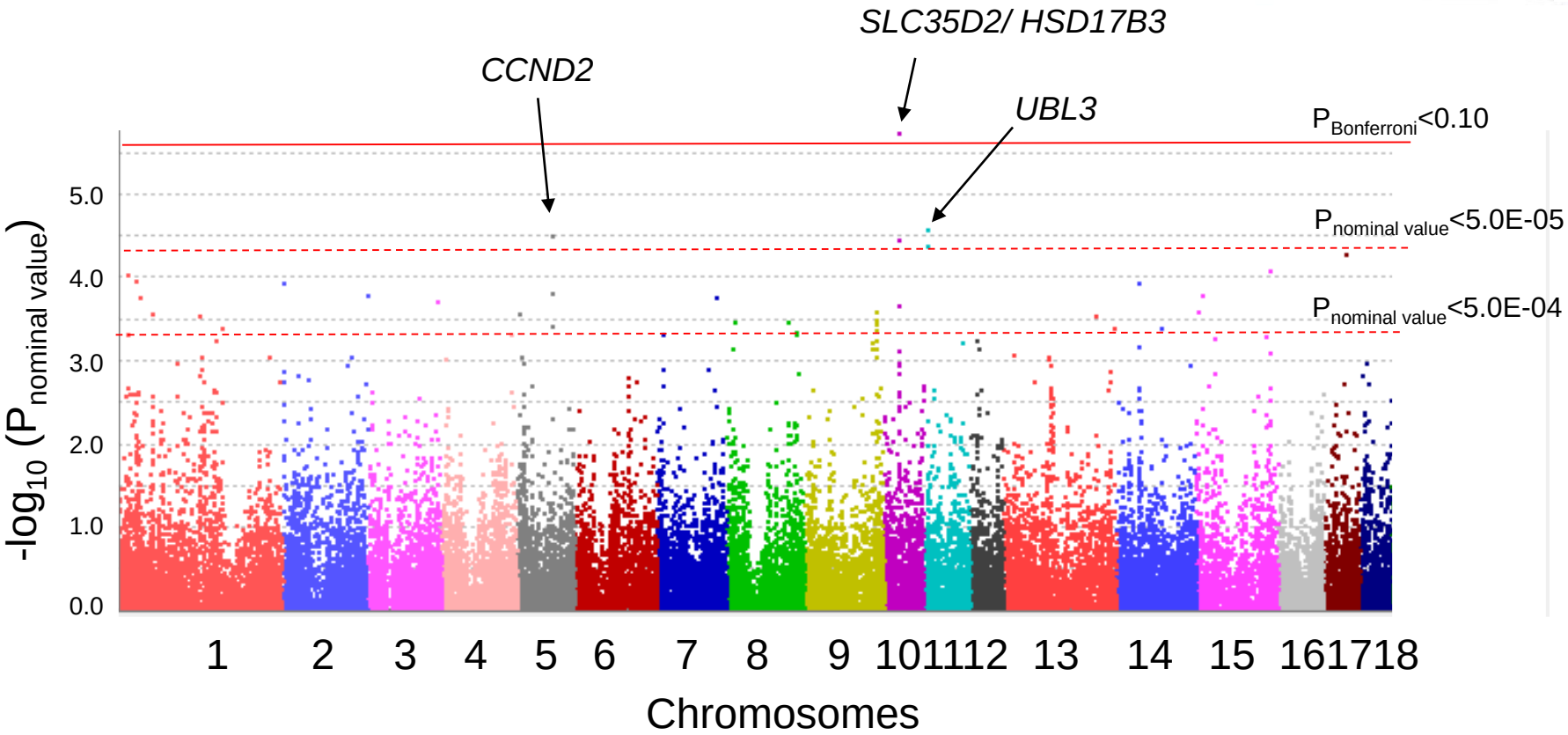
# Genome Wide Association Studies

HWLFS and VIF

PorcineSNP60 BeadChip

Genome space

# Genome Wide Association Study for HWLFS



# Results of the gene enrichment analyses

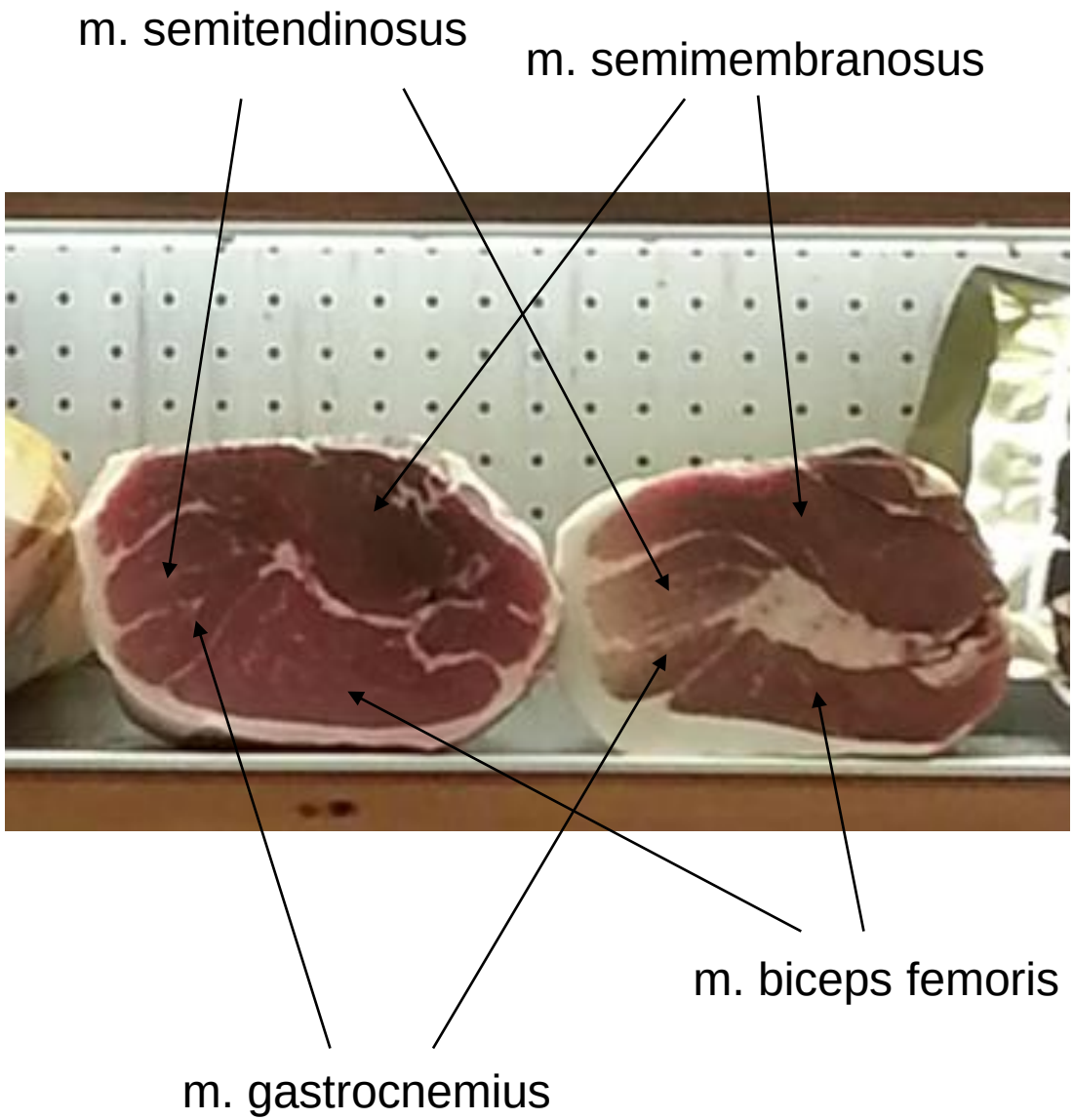
| Term/item | P-value[1] | Adjusted P-value[2] | Overlap[3] | Genes |
|---|---|---|---|---|
| **GO Molecular Function** | | | | |
| **protein tyrosine phosphatase activity (GO:0004725)** | 0.00035 | 0.0337 | 3/103 | EYA4, DUSP8, CDC14B |
| **protein tyrosine/serine/threonine phosphatase activity (GO:0008138)** | 0.00181 | 0.0587 | 2/46 | DUSP8, CDC14B |
| **phosphoprotein phosphatase activity (GO:0004721)** | 0.00149 | 0.0587 | 3/172 | EYA4, DUSP8, CDC14B |
| **Biological Process** | | | | |
| **neuron recognition (GO:0008038)** | 0.00087 | 0.1318 | 2/33 | DSCAM, EPHA3 |
| **peptidyl-tyrosine dephosphorylation (GO:0035335)** | 0.00029 | 0.1076 | 3/102 | EYA4, DUSP8, CDC14B |
| **KEGG table** | | | | |
| **cell cycle** | 0.0022 | 0.04253 | 3/104 | CCND2, EP300, CDC14B |
| **WikiPathway** | | | | |
| **Cell Cycle(Homo sapiens)** | 0.00064 | 0.02893 | 3/104 | CCND2, EP300, CDC14B |

[1] P nominal value
[2] Bonferroni adjusted P-value
[3] No. of genes included

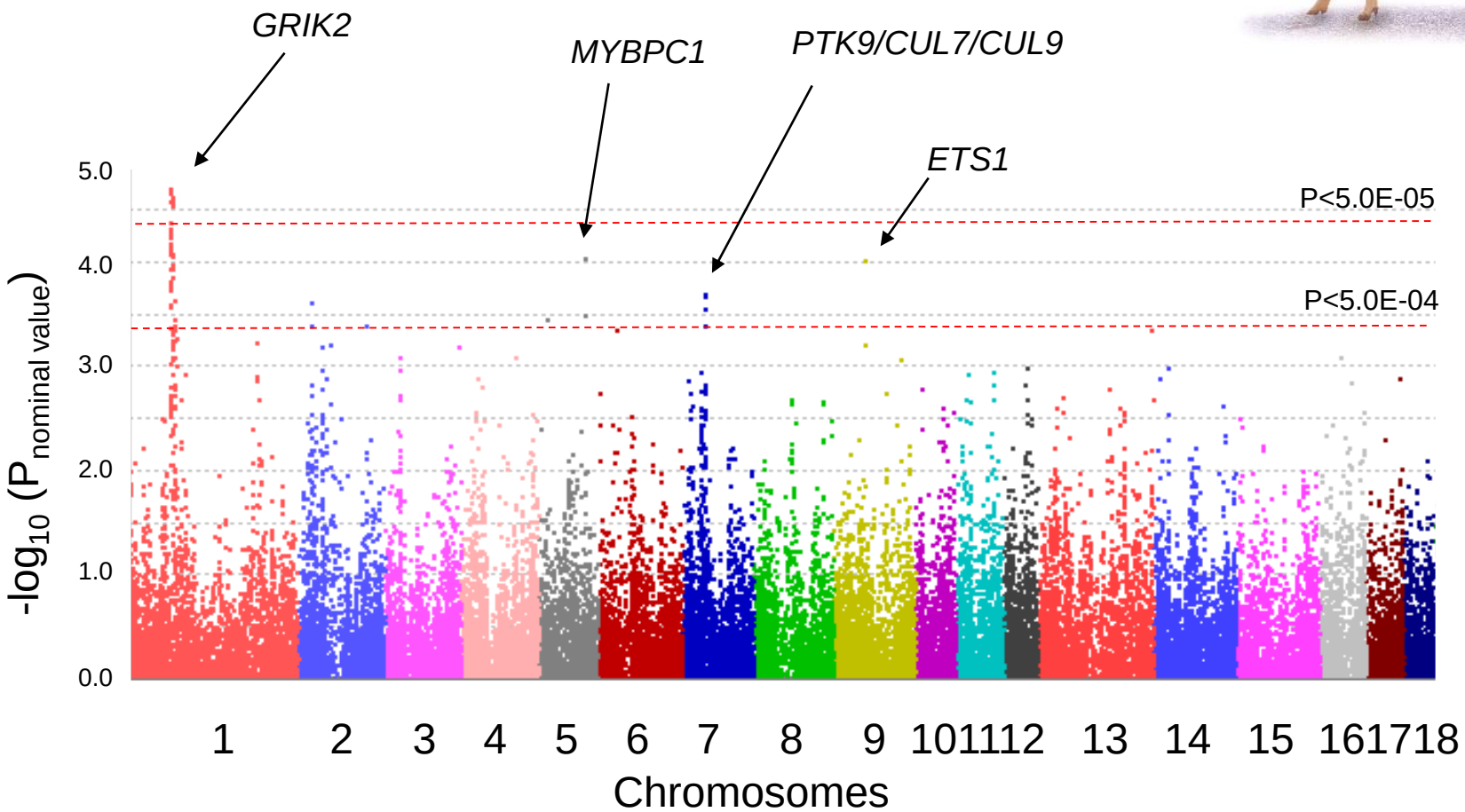
# Visible intermuscular fat (VIF)

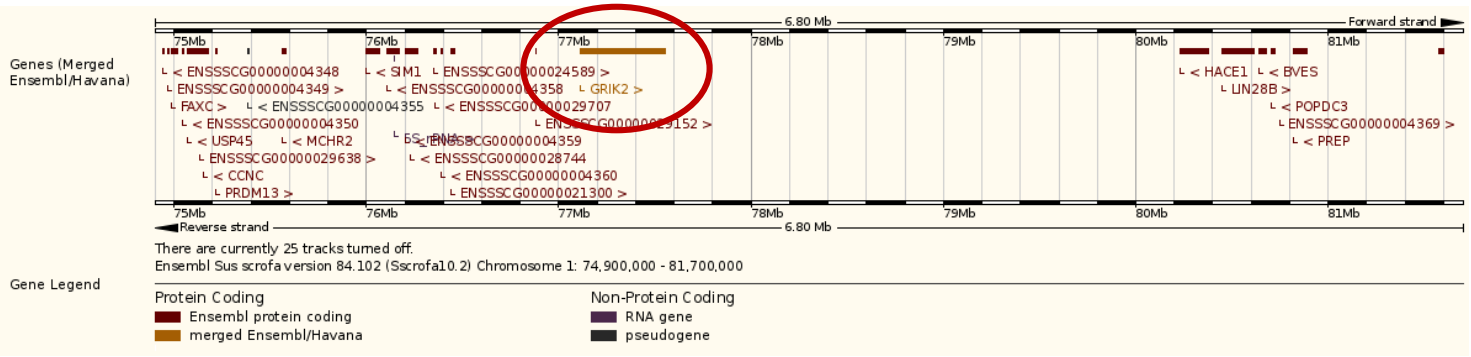
Yes

No



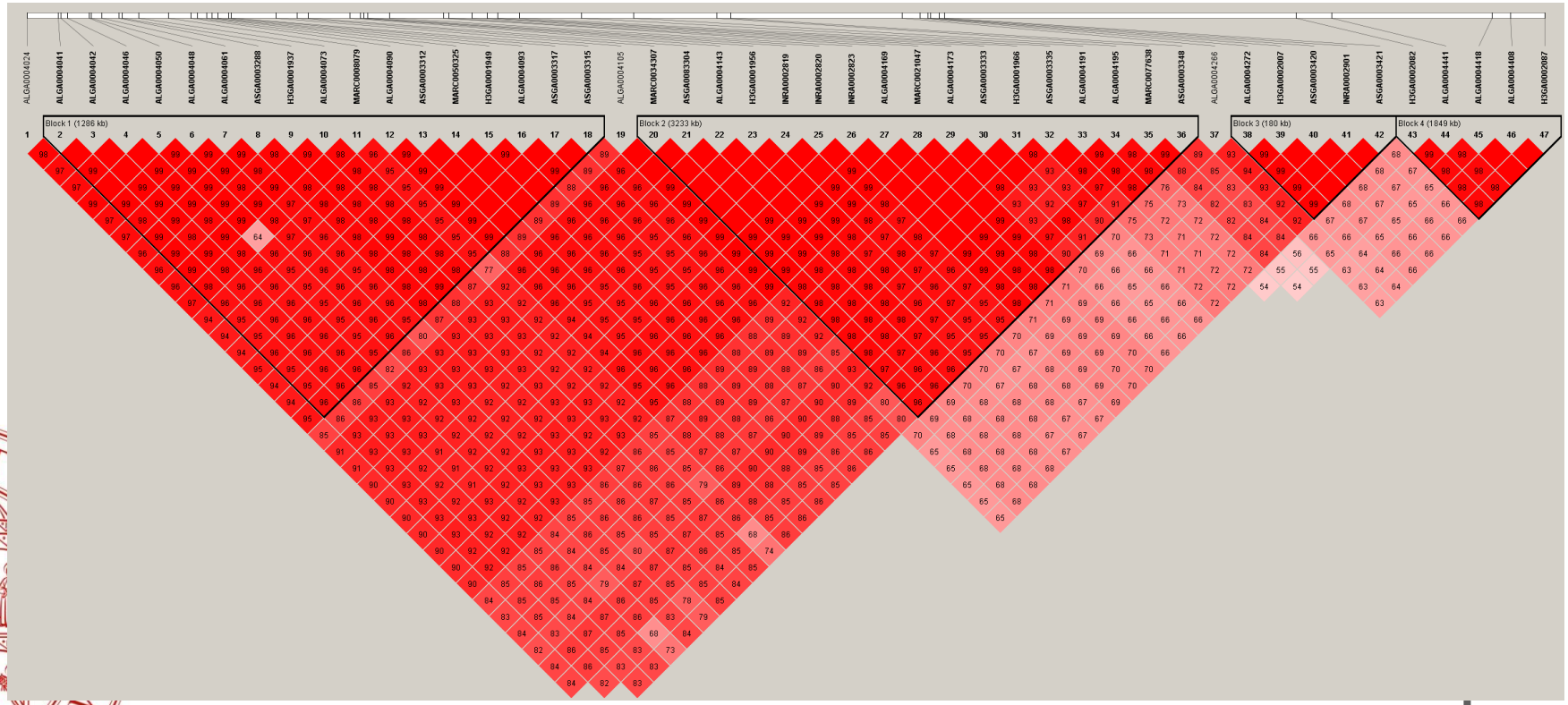
# Genome Wide Association Study for VIF





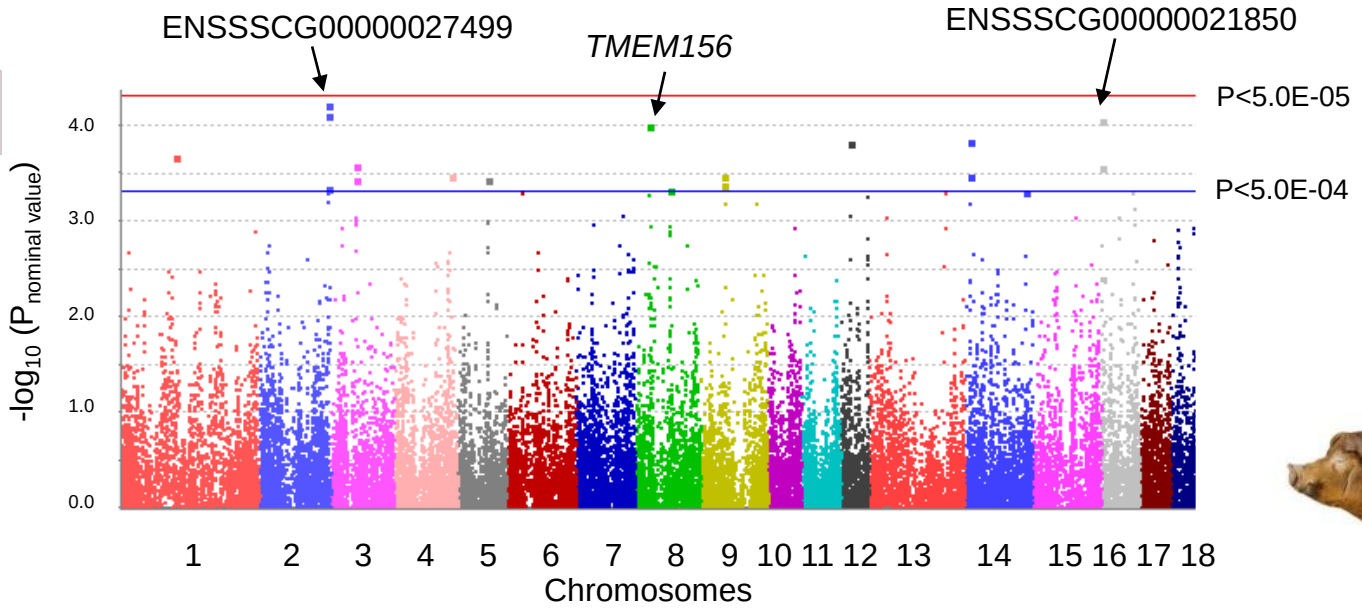

QTL region 1 (74.9-81.7 Mbp)

QTL region 2 (84.4-86.2 Mbp)

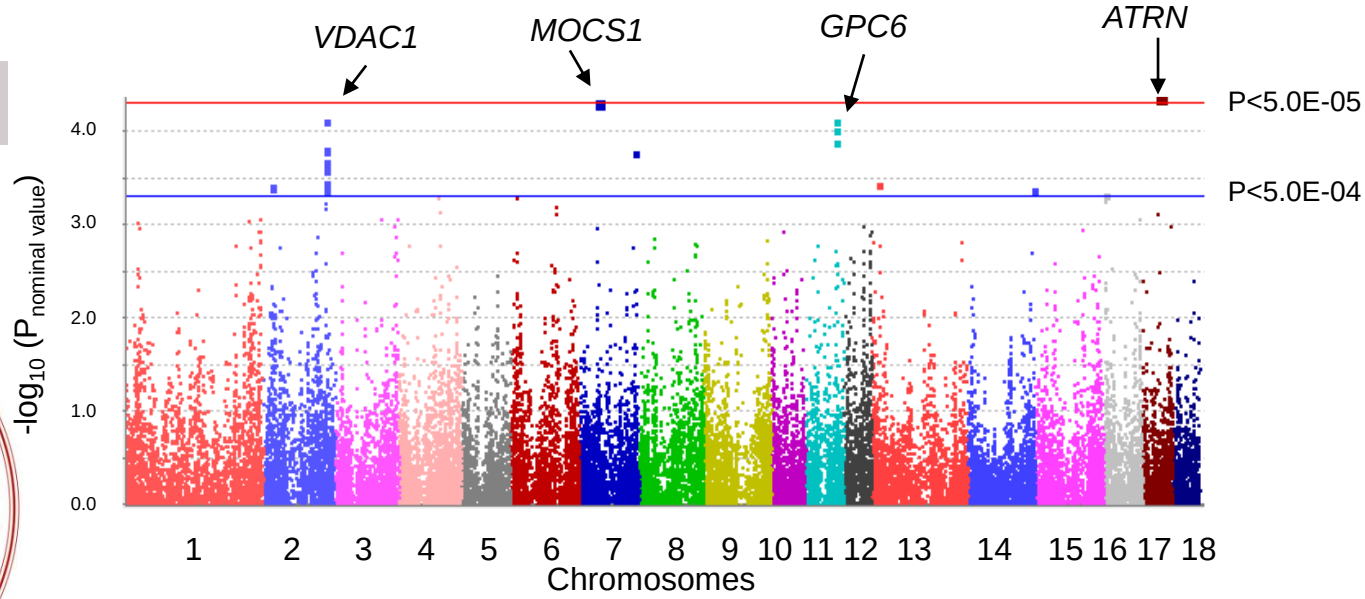


# Genome Wide Association Studies

**HWLFS**




**VIF**



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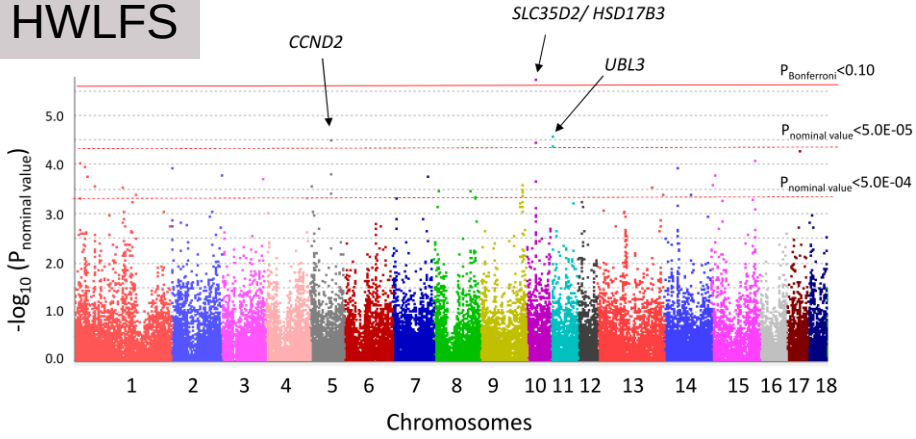


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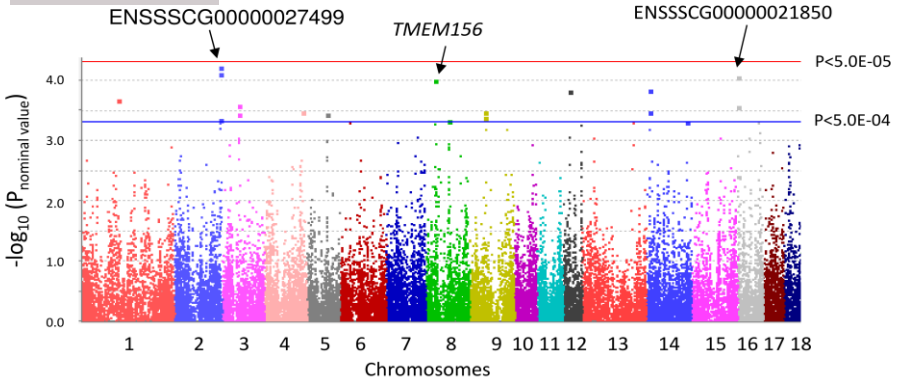


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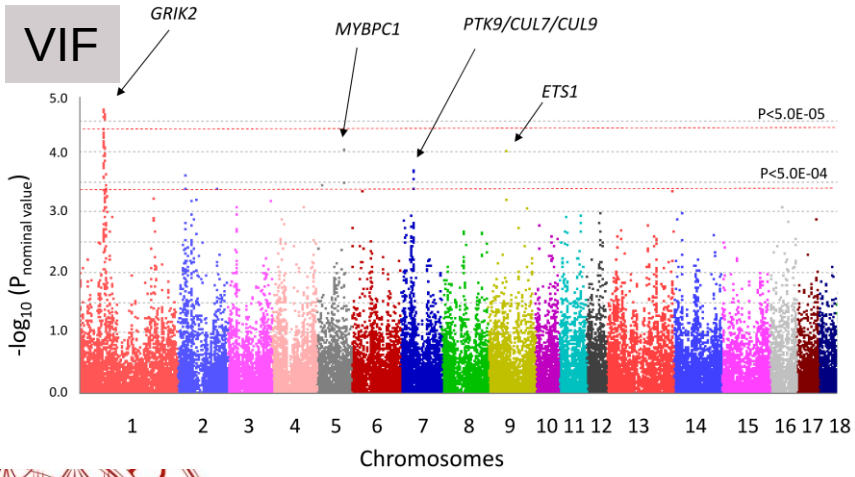


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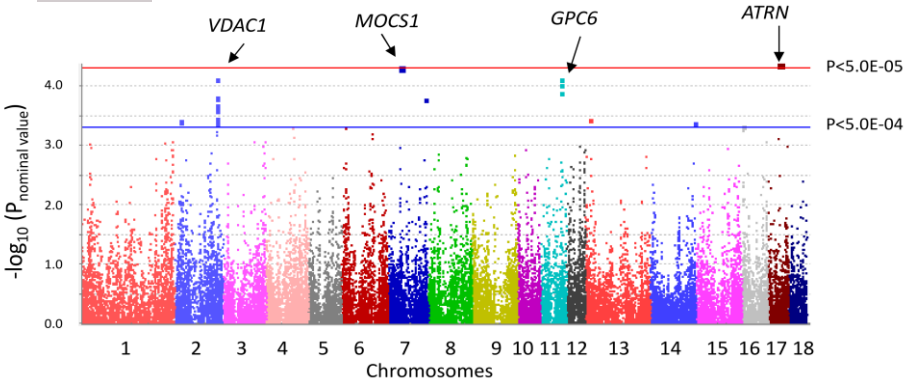
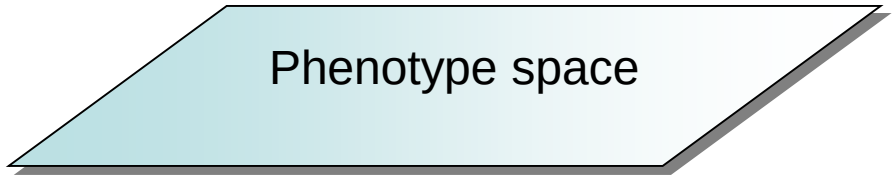
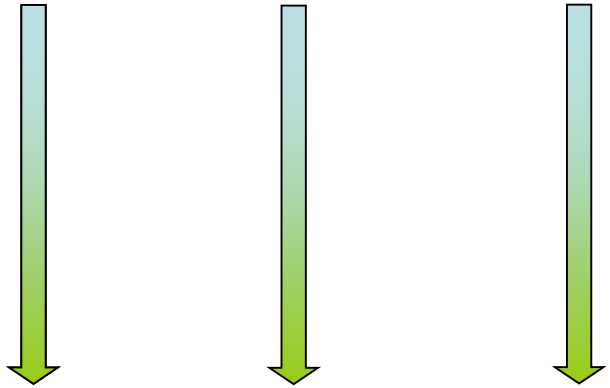


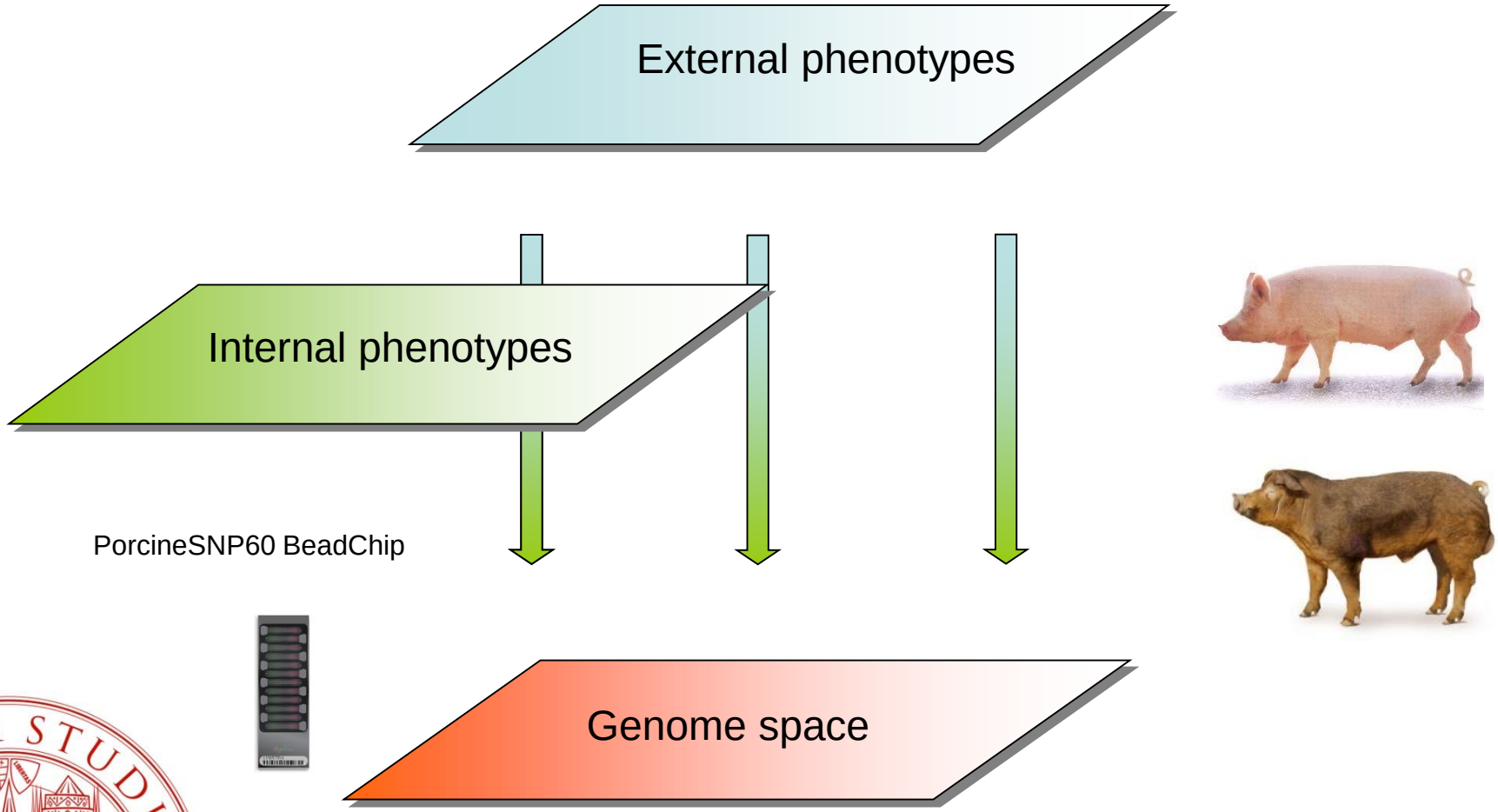
# Genome Wide Association Studies



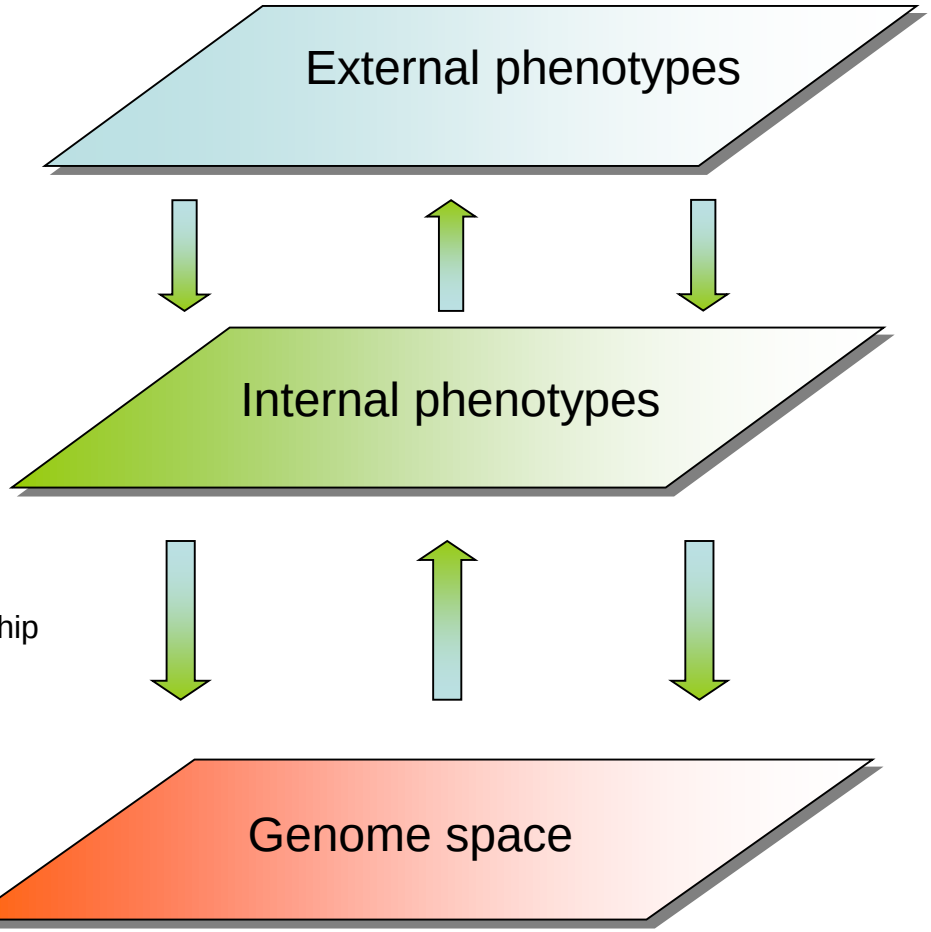



PorcineSNP60 BeadChip

# Genome Wide Association Studies

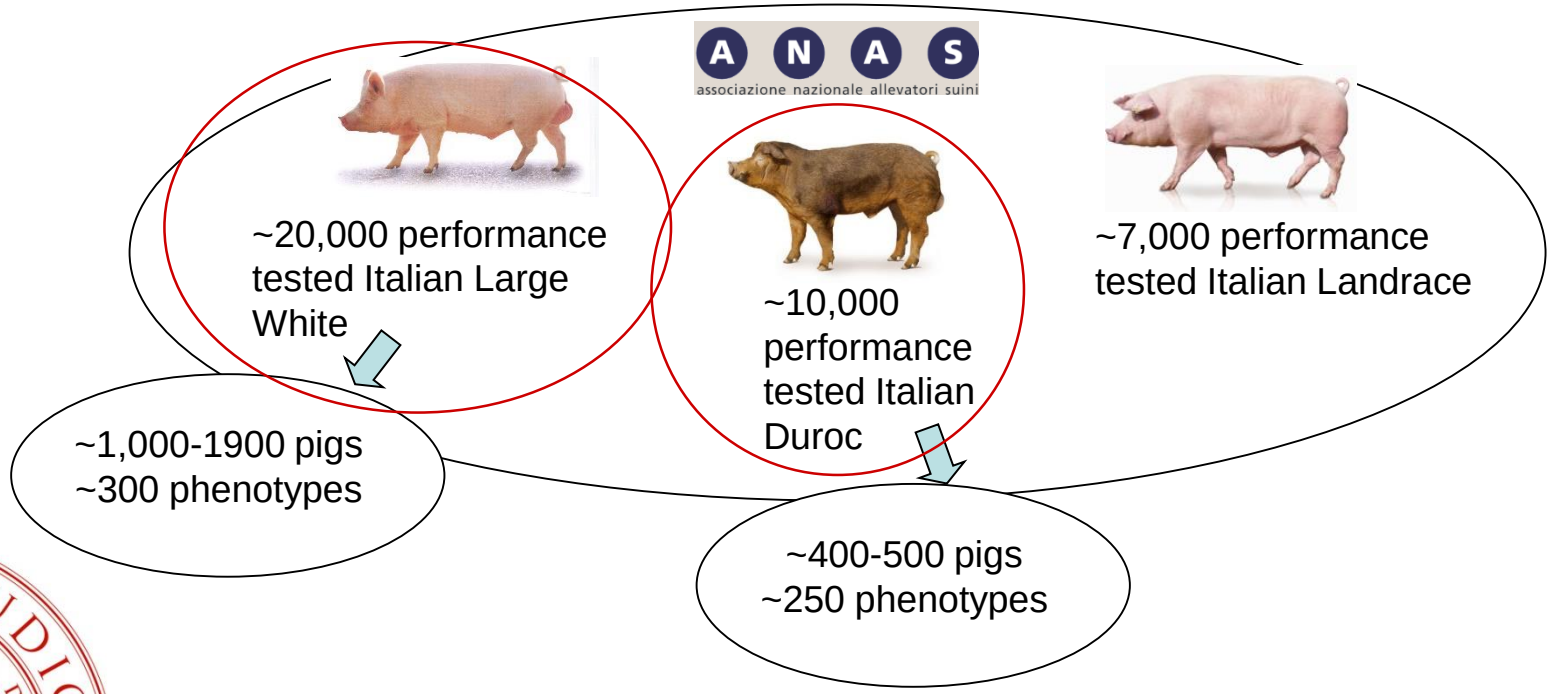


# Genome Wide Association Studies

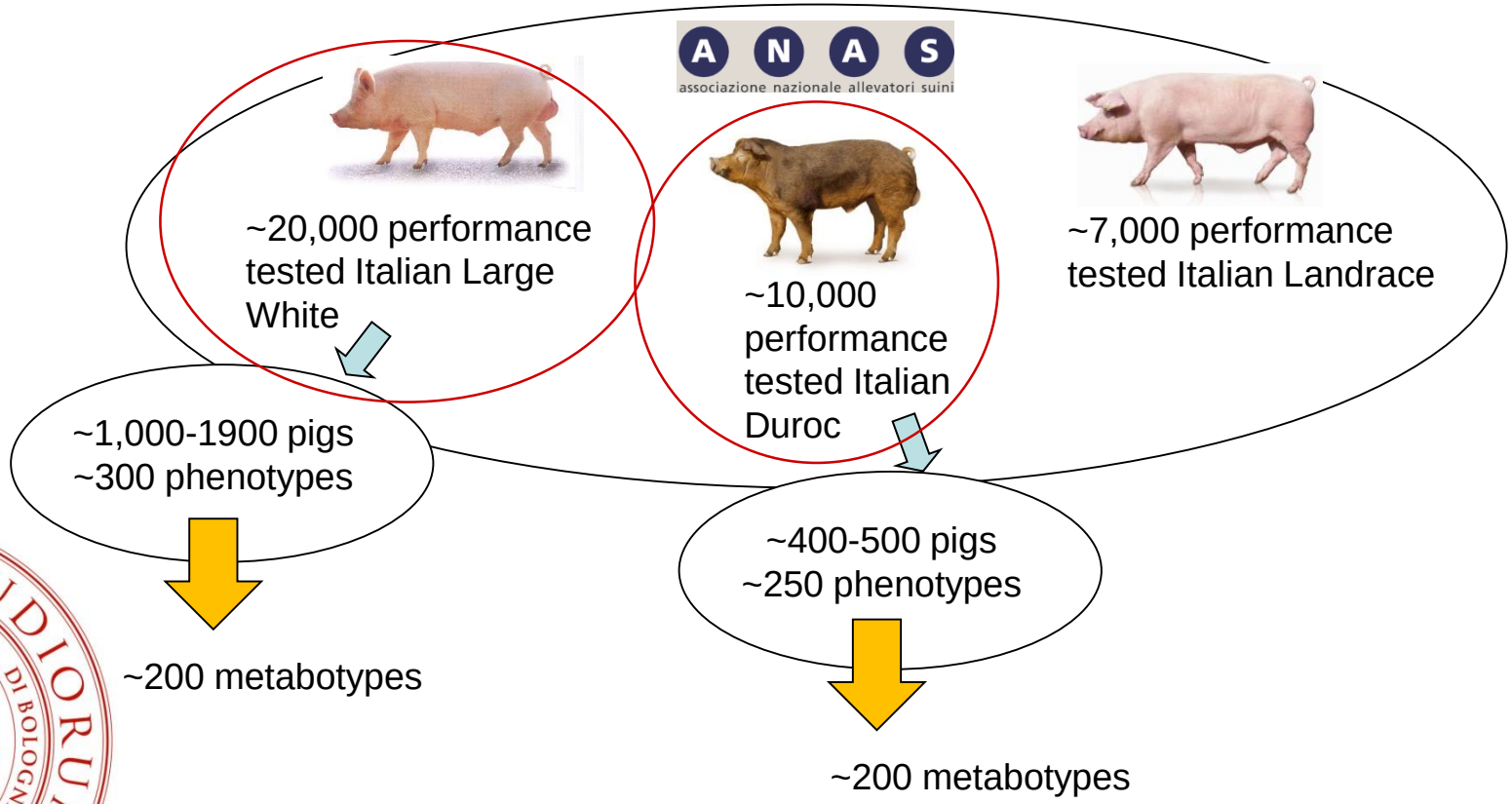



PorcineSNP60 BeadChip

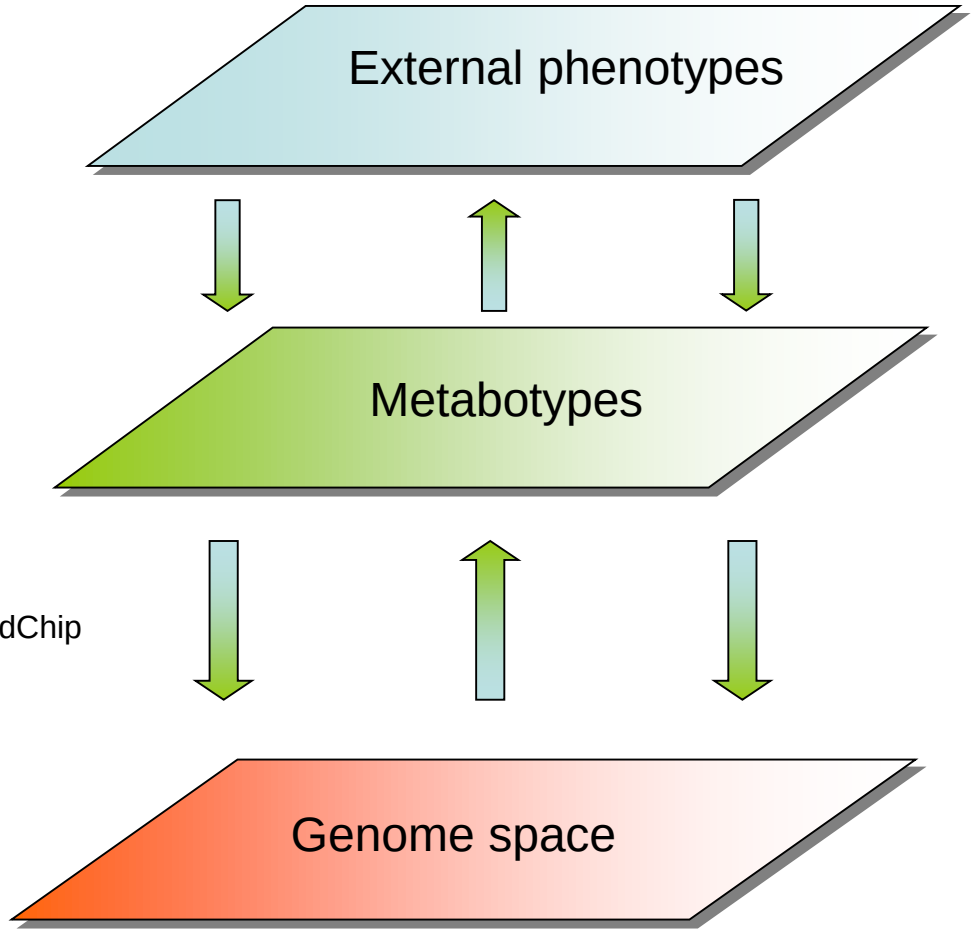
# Animal resources



# Animal resources

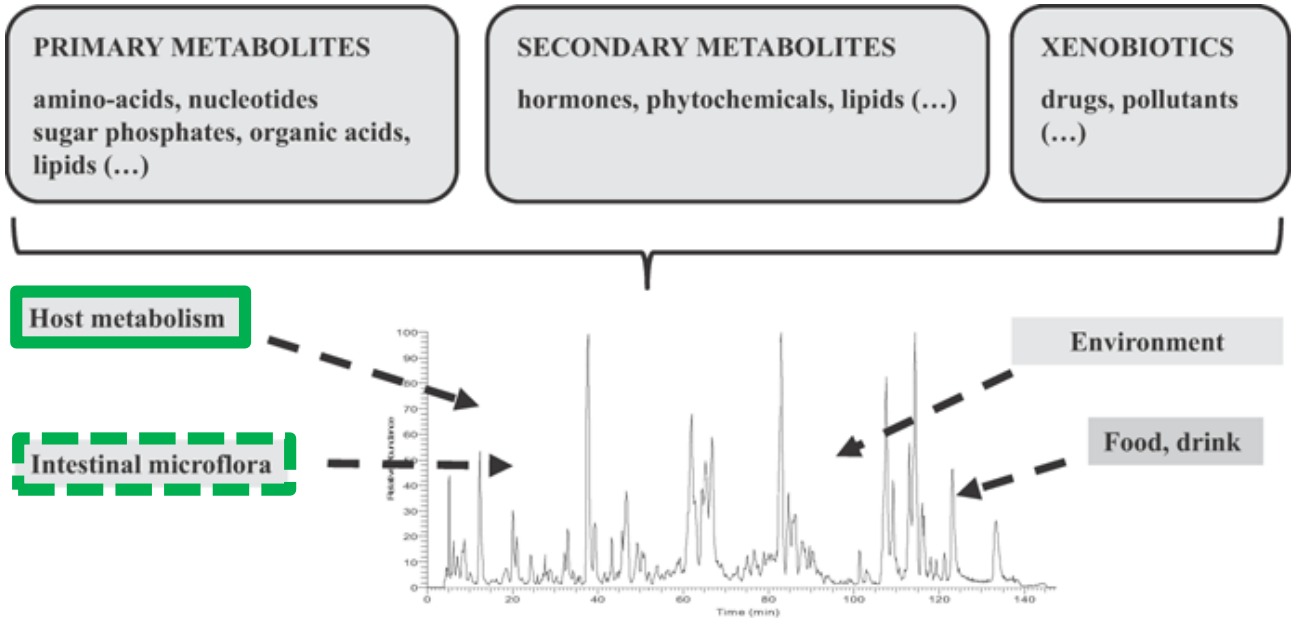


# Genome Wide Association Studies




PorcineSNP60 BeadChip

# Metabolomics measures all endogenous metabolites of a tissue or body fluid under given conditions

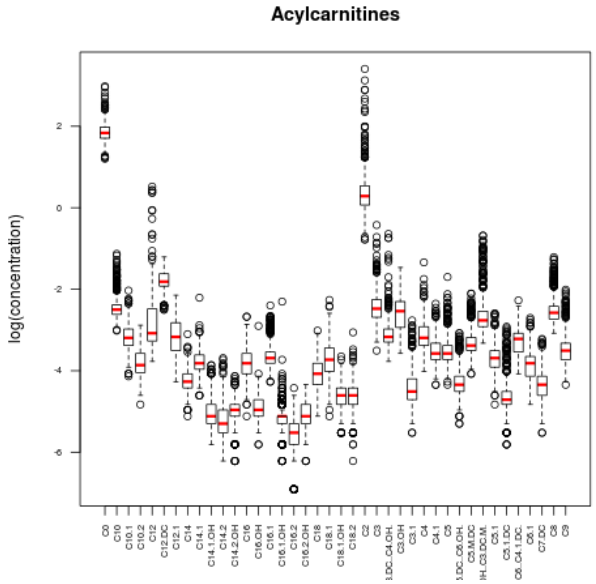


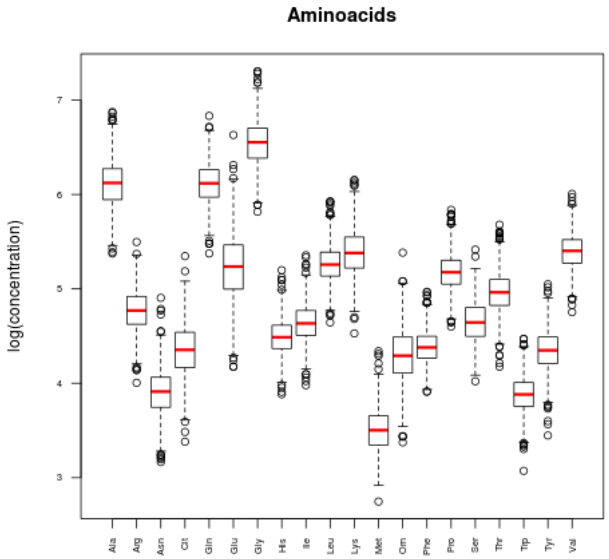

From Junot et al. 2014

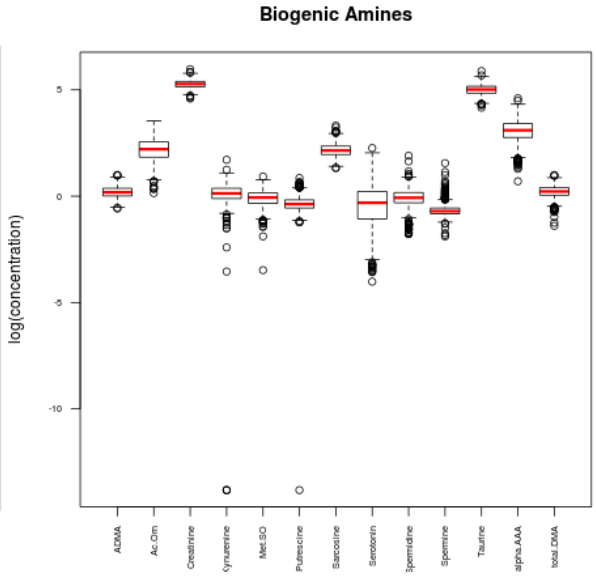
# METABOTYPES

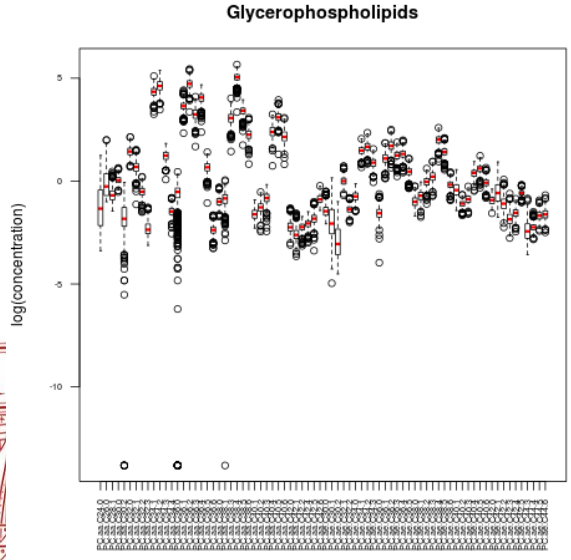
| Metabolyte classes | No. | Biological relevance (selected examples) |
|---|---|---|
| Acylcarnitines | 40 | Energy metabolism, fatty acid transport and mitochondrial fatty acid oxidation, ketosis, oxidative stress, mitochondrial membrane damage (apoptosis) |
| Amino acids | 21 | Amino acid metabolism, urea cycle, activity of gluconeogenesis and glycolysis, insulin sensitivity/resistance, neurotransmitter metabolism, oxidative stress |
| Biogenic amines | 19 | Neurological disorders, cell proliferation, cell cycle progression, DNA stability, oxidative stress |
| Hexoses | 1 | Carbohydrate metabolism |
| Glycerophospholipids | 90 | |
| - lysoPhosphatidylcholine acyl – lysoPC a Cx:x | 14 | Degradation of phospholipids (phospholipase activity), membrane damage, signalling cascades, fatty acid profile |
| - Phosphatidylcholine diacyl – PC aa Cx:x | 38 | Dyslipidemia, membrane composition and damage, fatty acid profile, activity of desaturases |
| - Phosphatidylcholine acyl-alkyl – PC ae Cx:x | 38 | |
| Sphingolipids | 15 | Signalling cascades, membrane damage (e.g. neurodegeneration) |

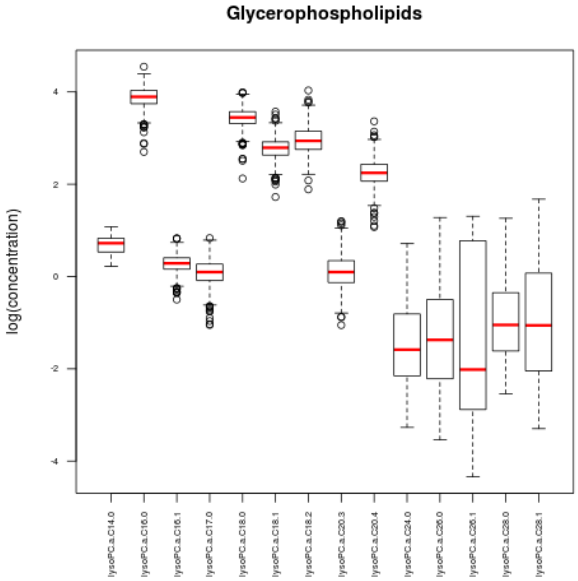
# METABOTYPES

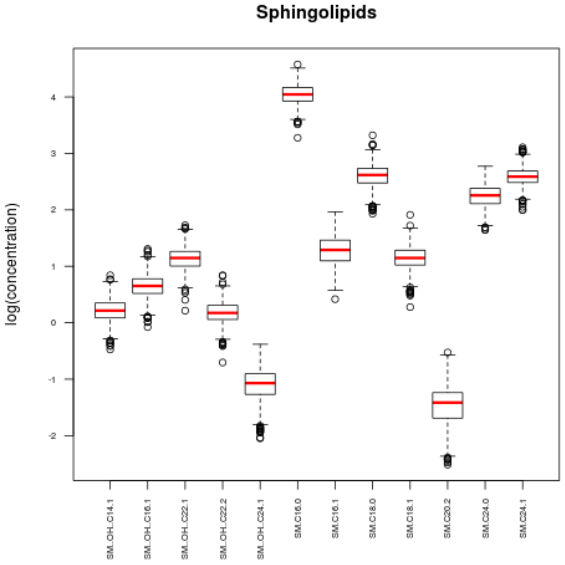


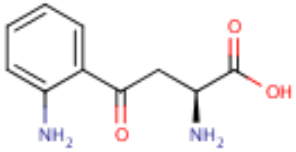



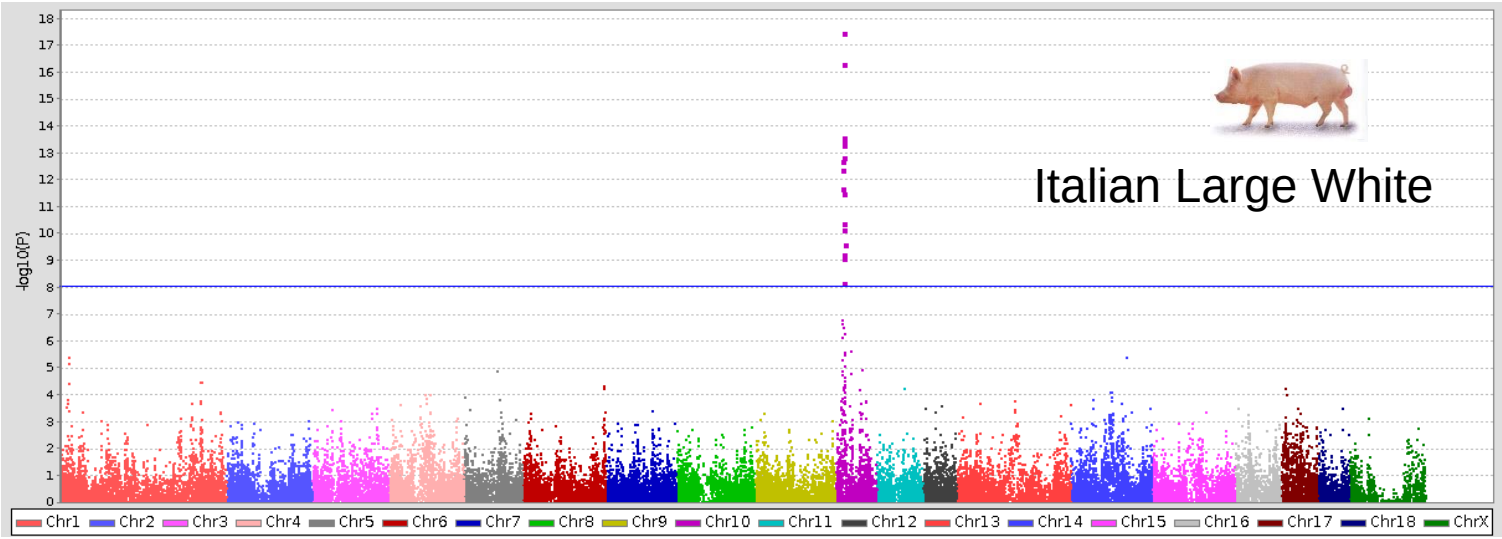



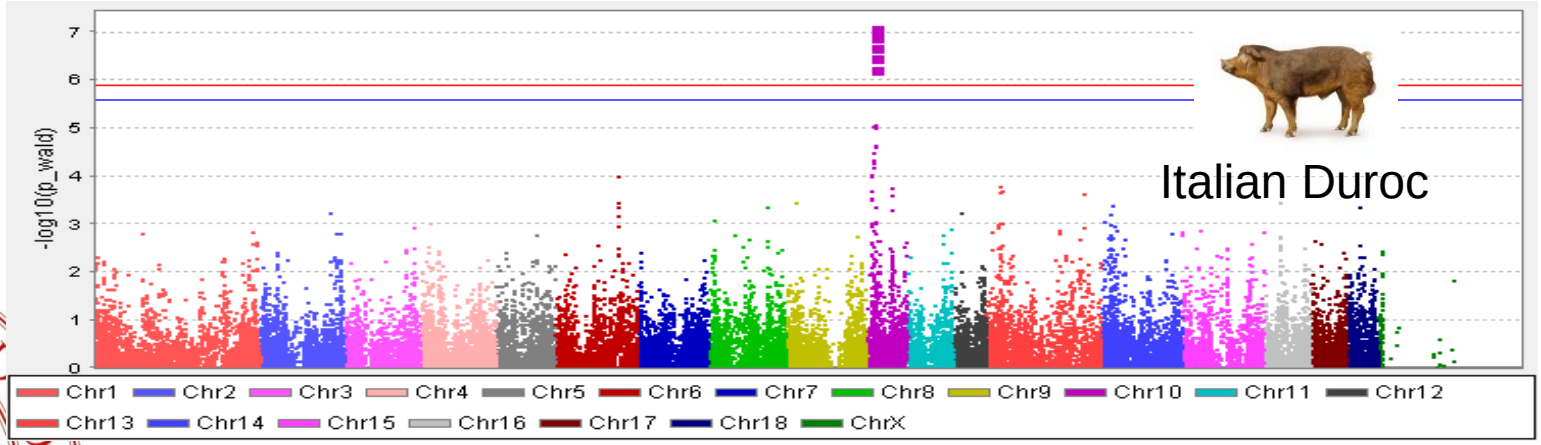



# Kynurenine

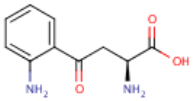


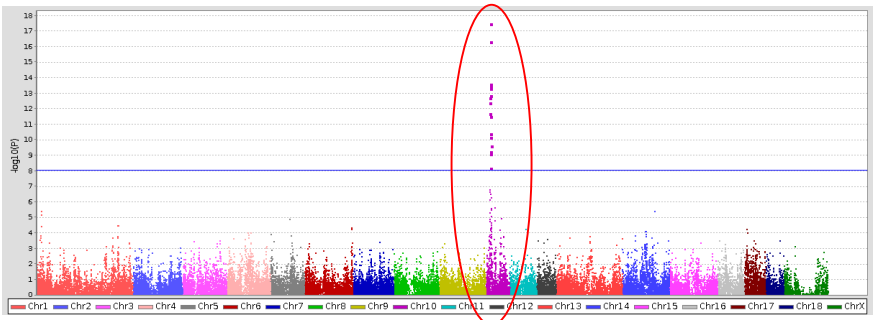



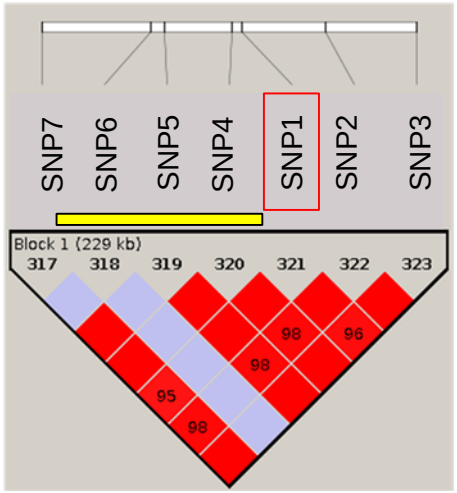



# Tryptophan catabolism

Kynurenine



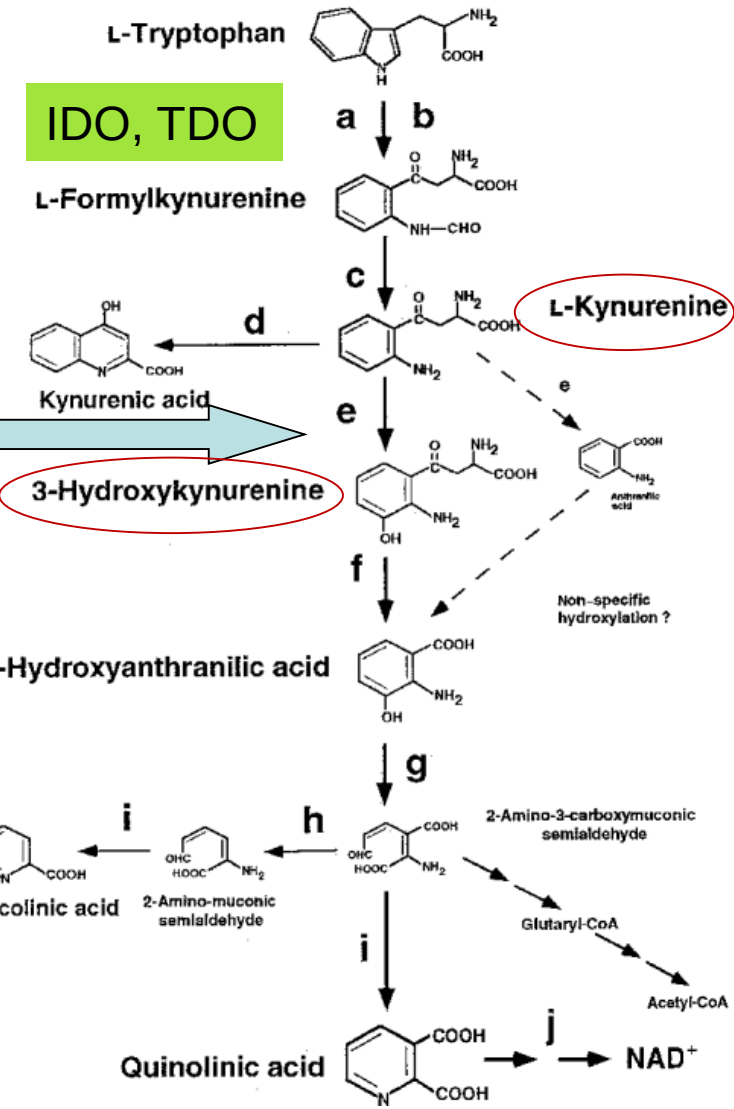





Kynurenine 3-monooxygenase (KMO)

Immunity/ inflammation

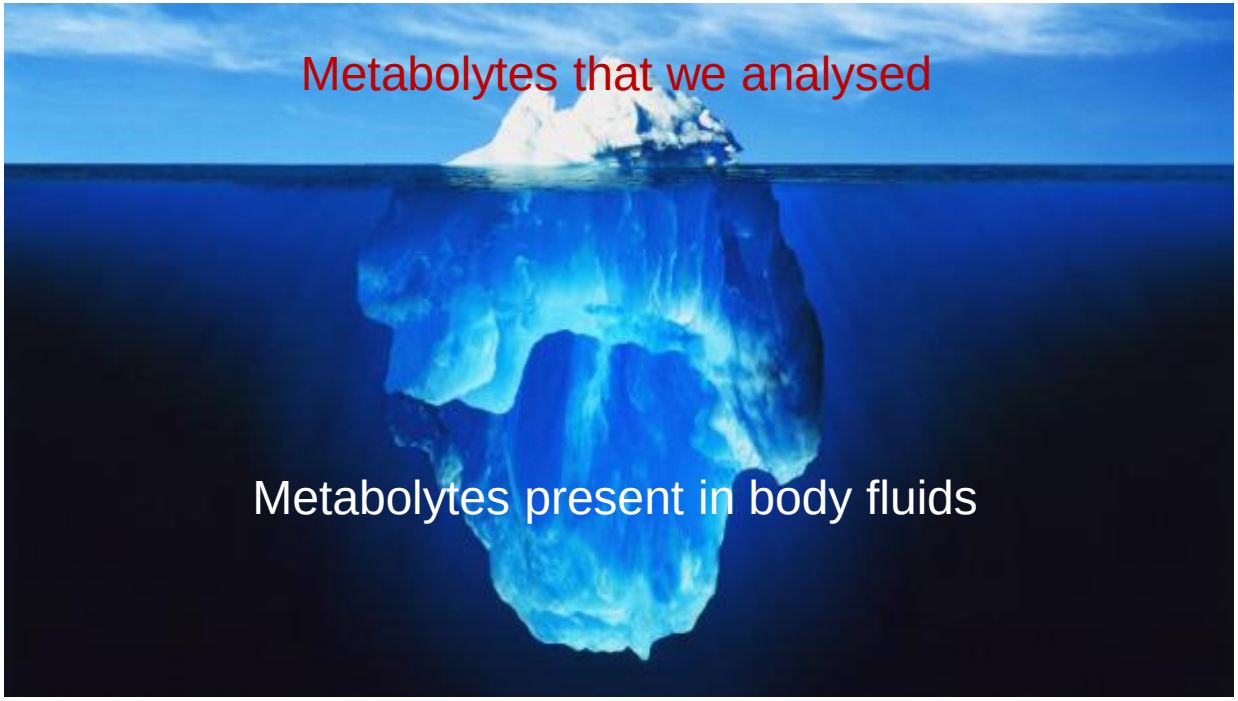
IDO, TDO




KMO

Behaviour

…… to be continued …….



# Conclusions

a) We have identified genes associated with meat quality traits for dry-cured ham production

b) The future of animal breeding relies on the analysis of as many phenotypes as possible

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**Funded by:**
Innovagen project (MiPAAF)
AGER project (Fondazioni Bancarie)
FARB project (University of Bologna)

# Schema di Selezione in pratica

Nuclei allevamento:
Registrazione dati e
Identificazione nidiate

Ritiro
gruppi SIB

Centro
Genetico
(*Reggio Emilia*)

Flusso operativo quindicinale

Stima Valore Genetico (BLUP Animal Model MT):

- Efficienza
- Caratteristiche carcassa
- Qualità carne

Tra I fratelli dei
gruppi migliori sono
scelti I Verri per la FA

Analisi DNA per parentela e gene alotano

Centro FA convenzionato
per la distruibuzione
pianificata seme ai nuclei
allevamento