

"Animal breeding and national animal products from a genomic point of view"

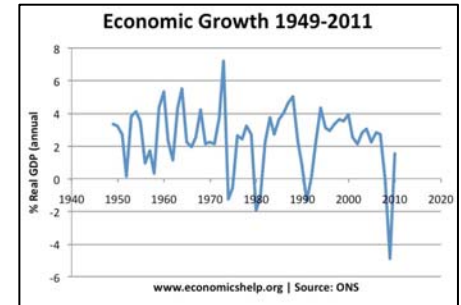
Anagnostis Argiriou

Researcher

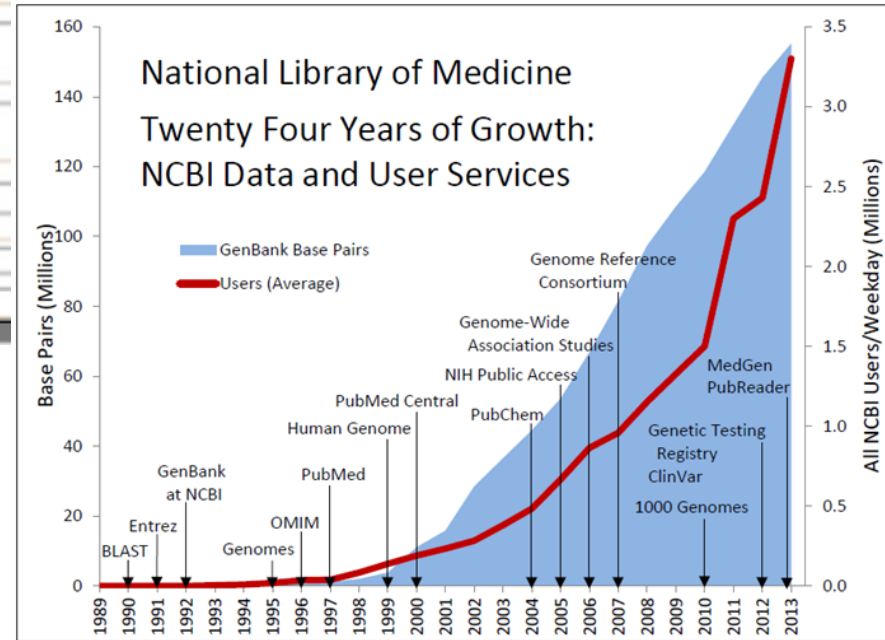
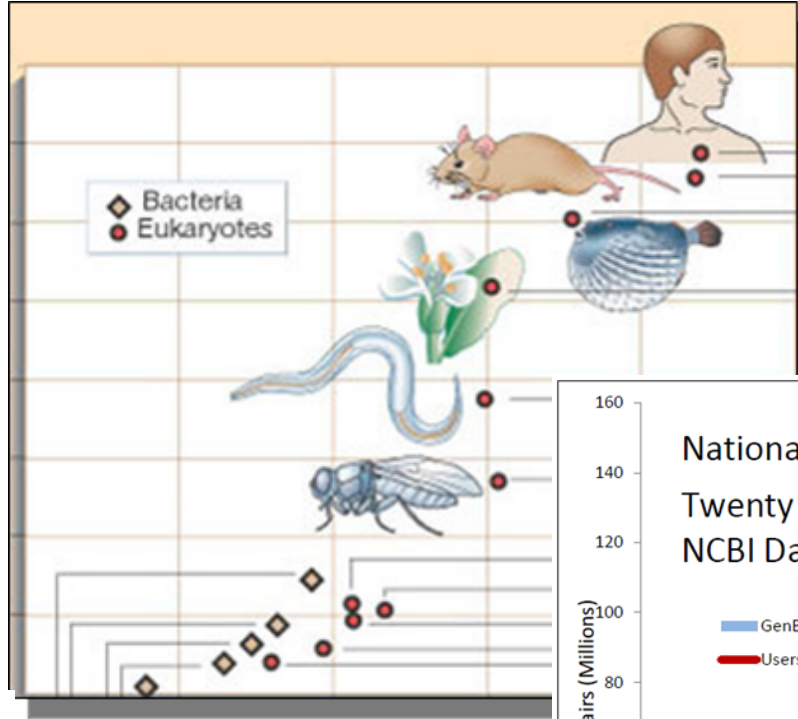
Institute of Applied Biosciences – CERTH

Innovation drivers

- Environmental
- Economic
- Social
- Technology
- Policy



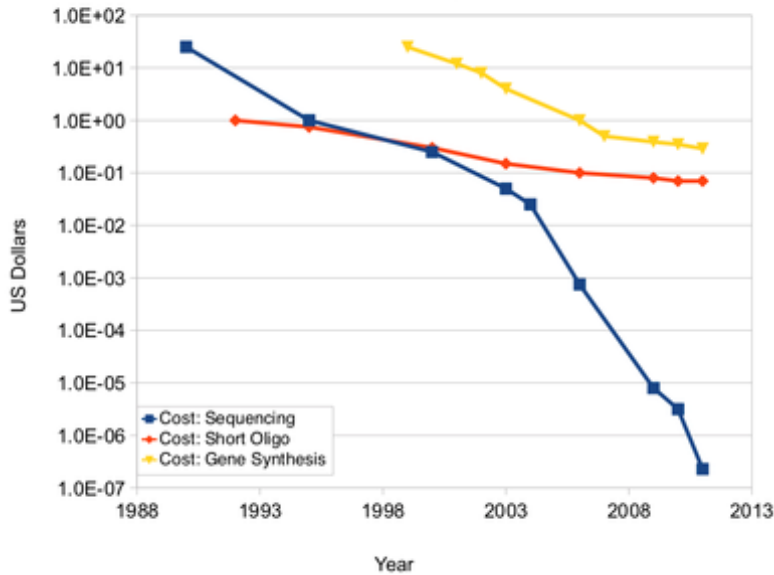
Genetics- Genomics



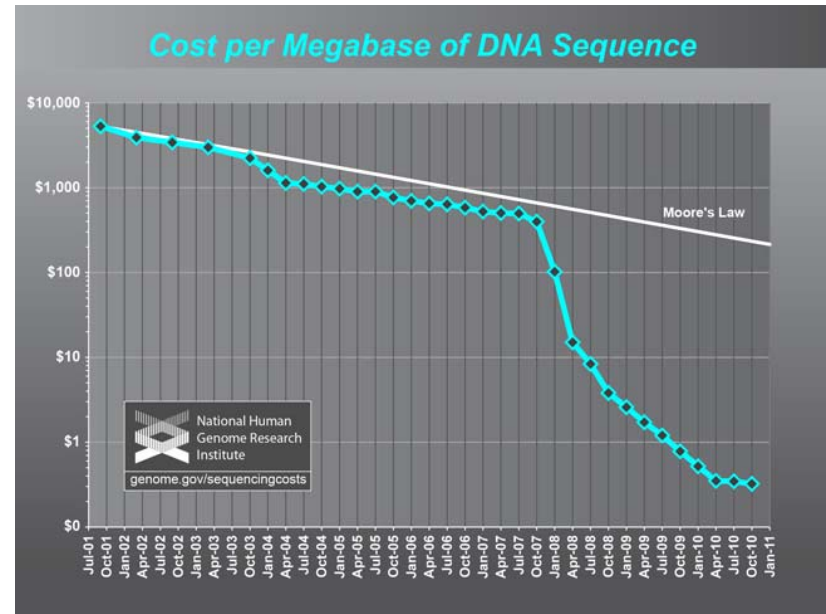
Cost of Sequencing

Cost Per Base of DNA Sequencing and Synthesis

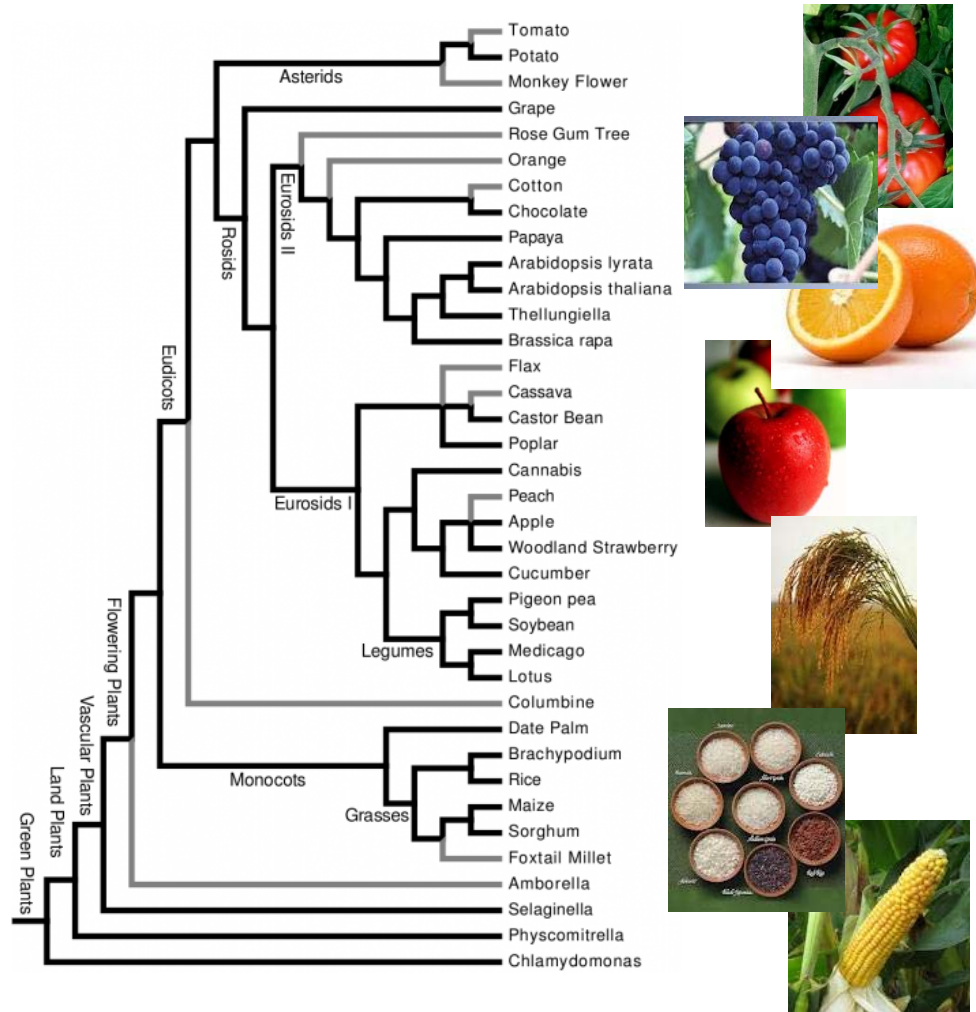
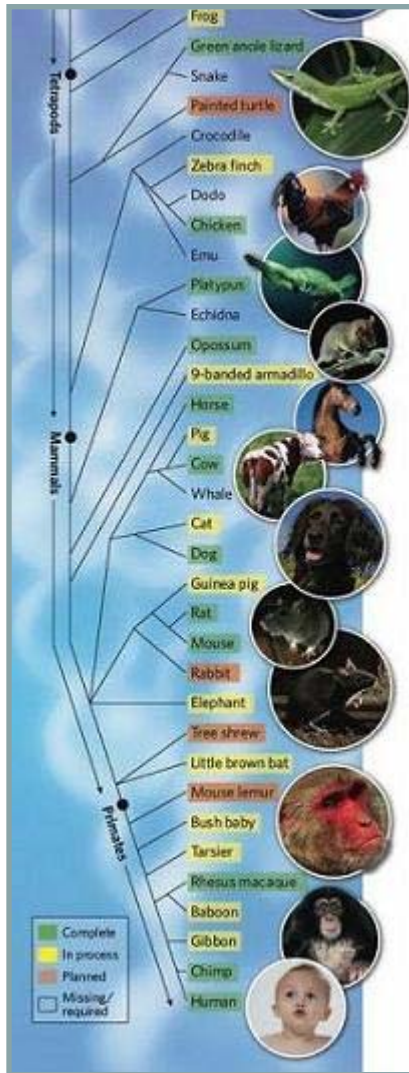
Rob Carlson, June 2011, www.synthesis.cc



Cost per Megabase of DNA Sequence



Sequenced Genomes



Genetic Epigenetic Polymorphisms

□ (SNP)

```

Query 1   TCCTTGC GACTGCTGTGAATTTCTGATGCACTTGGATAGTCTCTGTTACTCTAAAGTTT 60
          |||
Sbjct 221 TCCTTGC GACTGCTGTGAATTTCTGATGCACTTGGATAGTCTCTGTTACTCTAAAGTTT 280
    
```

□ Addition(I) or Deltion (D) of a sequence

```

Query 1   TCCTTGC GACTGCTGTGAATTTTGTGATGCA-----CTTGGATAGTCTCTGTT 48
          |||
Sbjct 1   TCCTTGC GACTGCTGTGAATTTTGTGATCAGCTTATTTCTCTCTTGGATAGTCTCTGTT 60
    
```

□ άλλοι (π.χ. επαναλήψεις μικροδορυφορικού DNA)

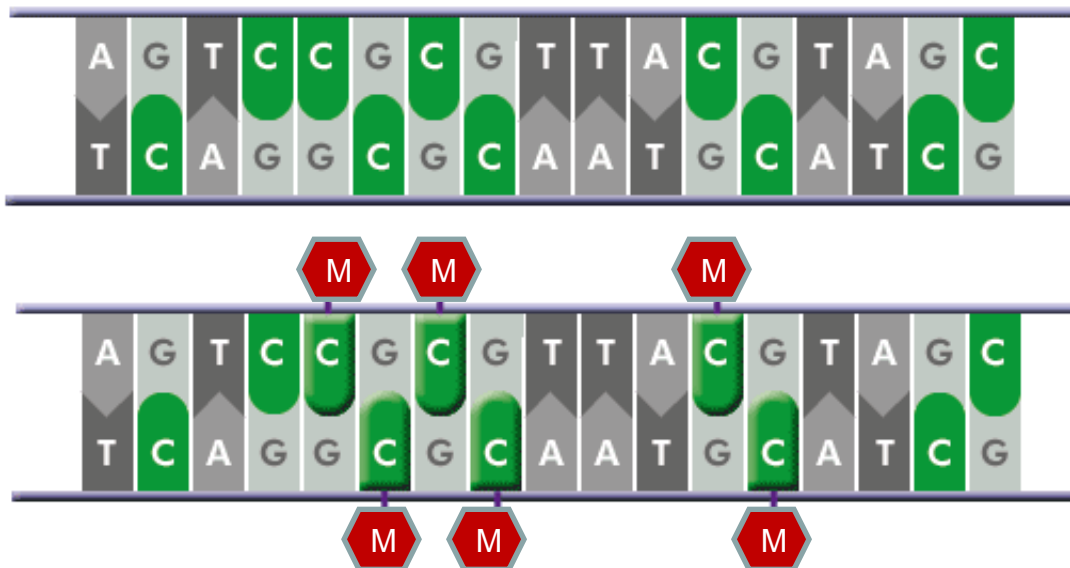
ΚΑΛΟΣ

ΚΑΚΟΣ

ΩΡΑΙΑ

ΠΑΝΩΡΑΙΑ

Epigenetic Polymorphisms



Καλός

Καλός



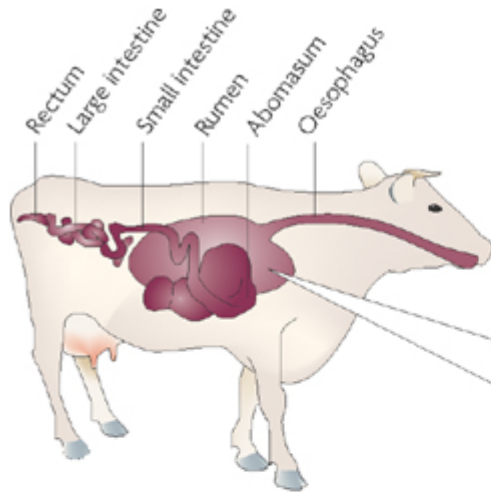
METAGENOMICS

Evolution of Mammals and Their Gut Microbes

Ruth E. Ley,¹ Micah Hamady,² Catherine Lozupone,^{1,3} Peter J. Turnbaugh,¹ Rob Roy Ramey,⁴ J. Stephen Bircher,⁵ Michael L. Schlegel,⁶ Tammy A. Tucker,⁶ Mark D. Schrenzel,⁶ Rob Knight,³ Jeffrey I. Gordon^{1*}



Gut Microbiome

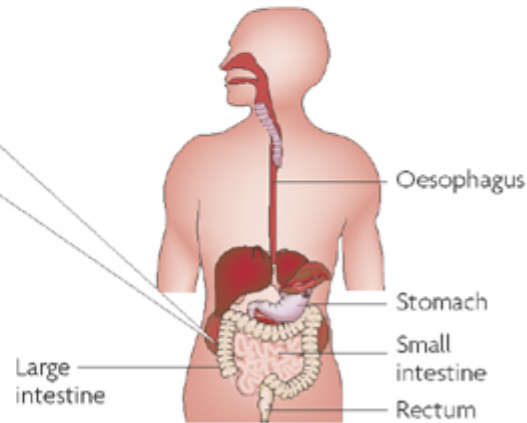


Rumen

- Bacteroidetes
Prevotella ruminicola (X,S)
Prevotella bryantii (X,S)
- Firmicutes
Butyrivibrio fibrisolvens (X,S)
Ruminococcus flavefaciens (C,X)
Ruminococcus albus (C,X)
Eubacterium cellulosolvens (C,X)
- Fibrobacter
Fibrobacter succinogenes (C)
Fibrobacter intestinalis (C)

Human large intestine

- Bacteroidetes
Bacteroides thetaiotaomicron (S)
Bacteroides ovatus (X,S)
Bacteroides cellulosilyticus (C)
Bacteroides sp. nov. (X)
- Firmicutes
Roseburia intestinalis (X,S)
Roseburia inulinivorans (I,S)
Ruminococcus bromii (S)
Ruminococcus sp. nov. (C,X)
Eubacterium rectale (S)
- Actinobacteria
Bifidobacterium adolescentis (S)



Nature Reviews Microbiology

Animal Breeding and Genomics Centers

- Can I genetically select dairy cows based on their emission of methane?
- Is it possible by measuring gene activity to find out whether chicken have good gut health?
- How do we store genetic material for future generations best?

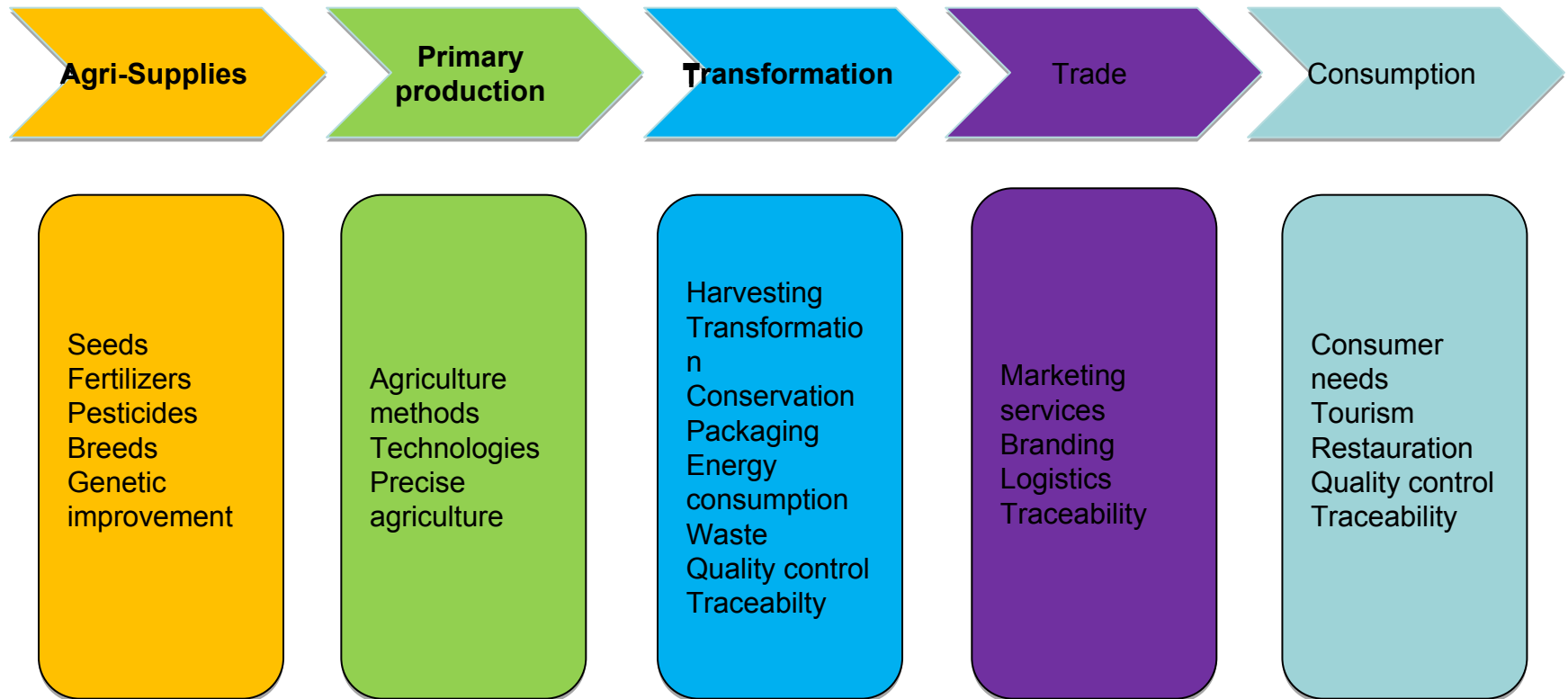
Single Nucleotide Polymorphisms (SNPs) Microarrays



Bovine and Ovine Genotyping BeadChip

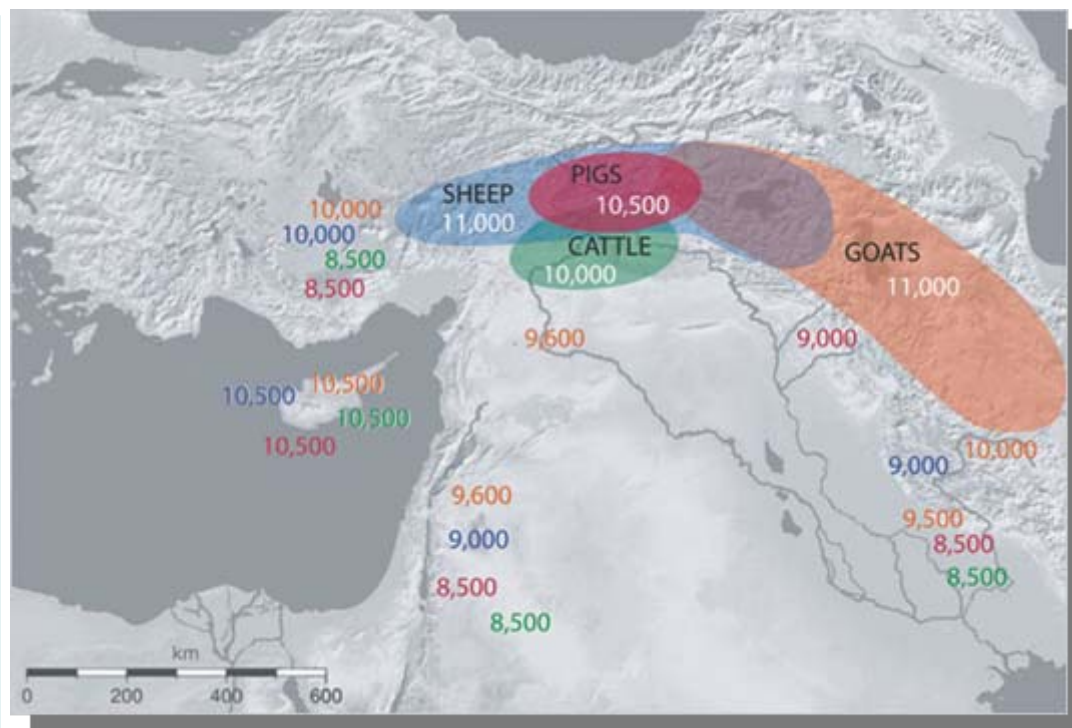
- The BovineLD BeadChip enables accurate genotyping to understand the impact of genetics on milk production, reproduction, health
- 80,000 custom markers for bovine
- 42,000 custom markers for ovine

Agri-Food Chain

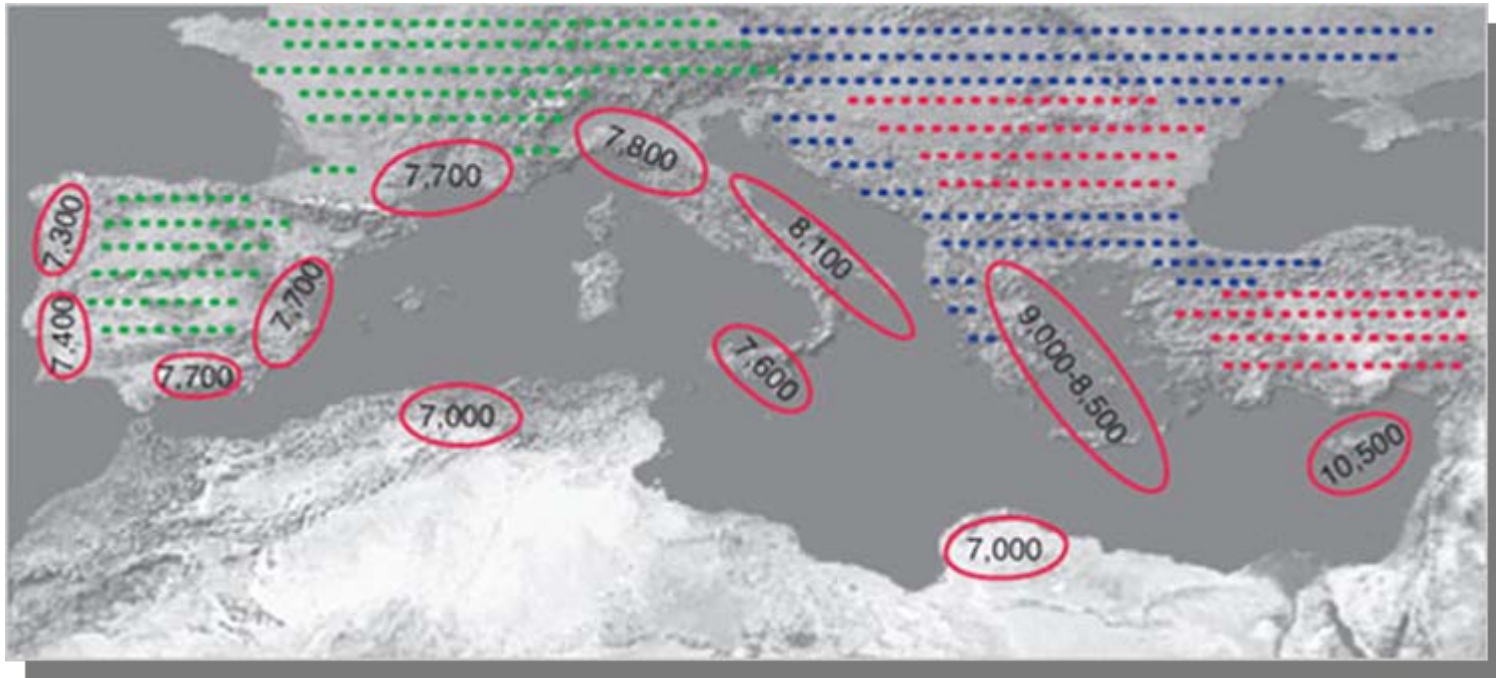


Domestication of Animals

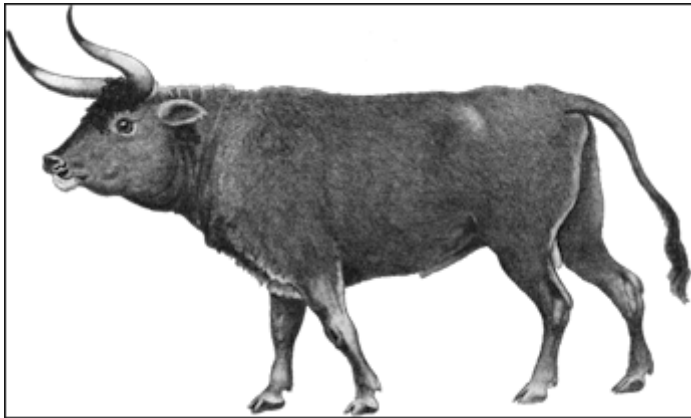
- Domestication was done in different areas in different periods
- **First time in Mesopotamia (11.000 b.p.)**
- First domesticated species: sheep and goats (9.000 -11.000 b.p.)
- **Followed pigs (8.500 – 10.500 b.p.) and cattle (8.000 -10.000 b.p.).**



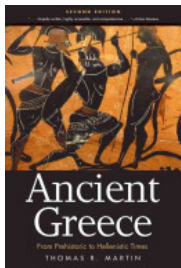
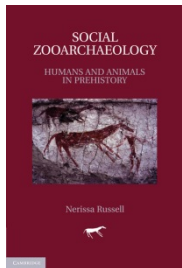
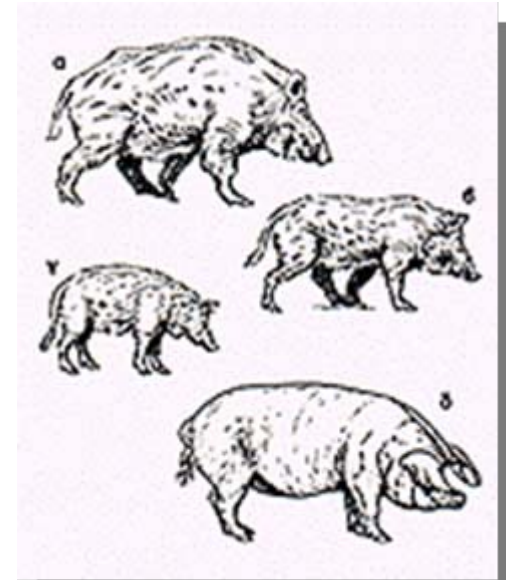
Expansion of Animal domestication



Animals in the Neolithic period in Greece



Taurus primegenius ή *Bos primigenius*



The Animal Husbandry in Bronze and Iron Age





Autochthonous Animals in Greece



Autochthonous Animals

Species	Registered/referred races
Cattle	36
Buffalo	1
Chicken	13
Donkeys	4
Goats	39
Horses	20
Pigs	6
Sheep	46

What happened the last 60 year in Greece

Autochthonous species were predominant till 50s

Substituted by imported more productive races

Extensive livestock converted to intensive



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1. [Distribution of Fasciola hepatica and F. gigantica in the endemic area of Guilan, Iran: Relationships between zonal overlap and phenotypic traits.](#)

Ashrafi K,
Infect Genet
PMID: 25602
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[Response of growing ruminants to diet in warm climates: a meta-analysis.](#)

1. Salah N, Sauvant D, Archimède H.
Animal. 2015 Jan 20:1-9. [Epub ahead of print]
PMID: 25602578 [PubMed - as supplied by publisher] [Related citations](#)

[In vitro fermentation of total mixed ration with different inocula and substrates.](#)

2. Serment A, Giger-Reverdin S,
J Sci Food Agric. 2015 Jan 7. doi: 10.1002/jsfa.6811
PMID: 25581524 [PubMed - as supplied by publisher] [Related citations](#)

[Response of growing ruminants to diet in warm climates: a meta-analysis.](#)

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[Pyogranulomatous pneumonia in goats caused by an undescribed Porphyromonas species: 'Porphyromonas katsikii'.](#)

1. Filioussis G, Petridou E, Karavanis E, Frey J.
J Clin Microbiol. 2014 Dec 24. pii: JCM.02682-14. [Epub ahead of print]
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[Pyogranulomatous pneumonia in goats caused by an undescribed Porphyromonas species: 'Porphyromonas katsikii'.](#)

1. Filioussis G, Petridou E, Karavanis E, Frey J.
J Clin Microbiol. 2014 Dec 24. pii: JCM.02682-14. [Epub ahead of print]
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UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

GENETIC CHARACTERIZATION OF INDIGENOUS GOAT POPULATIONS OF MOZAMBIQUE

Date Submitted: January 2007



Figure 1.3. Map of Mozambique and distribution of Pafuri goat and photograph



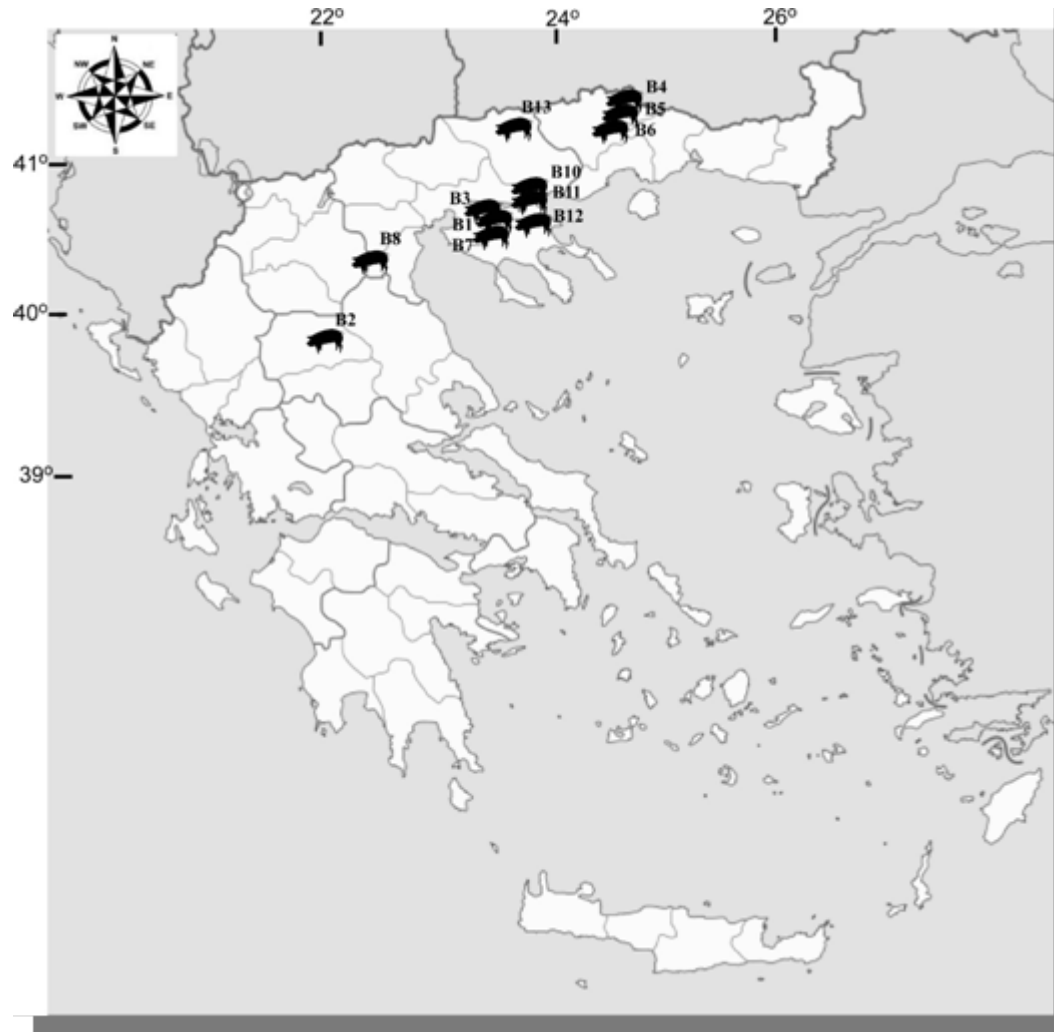
**nature
biotechnology**

OPEN

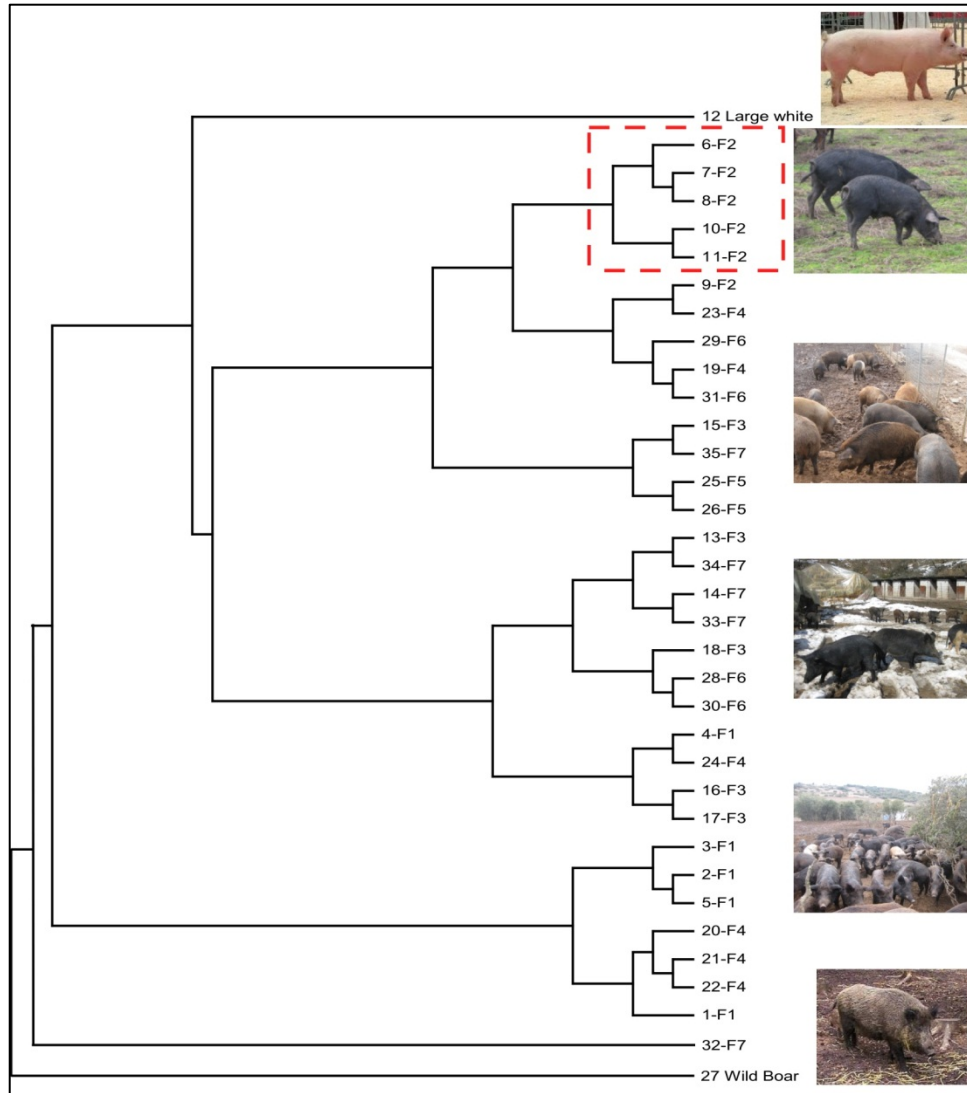
Sequencing and automated whole-genome optical mapping of the genome of a domestic goat (*Capra hircus*)

Yang Dong^{1,2,12}, Min Xie^{3,12}, Yu Jiang^{1,5,12}, Nianqing Xiao^{10,12}, Xiaoyong Du^{4,12}, Wenguang Zhang^{1,6,12}, Gwenola Tosser-Klopp⁷, Jinhuan Wang¹, Shuang Yang³, Jie Liang³, Wenbin Chen³, Jing Chen³, Peng Zeng³, Yong Hou³, Chao Bian³, Shengkai Pan³, Yuxiang Li³, Xin Liu³, Wenliang Wang³, Bertrand Servin⁷, Brian Sayre¹¹, Bin Zhu¹⁰, Deacon Sweeney¹⁰, Rich Moore¹⁰, Wenhui Nie¹, Yongyi Shen^{1,2}, Ruoping Zhao¹, Guojie Zhang³, Jinqian Li⁶, Thomas Faraut⁷, James Womack⁹, Yaping Zhang¹, James Kijas⁵, Noelle Cockett⁸, Xun Xu¹⁻³, Shuhong Zhao⁴, Jun Wang³ & Wen Wang¹

The Example of Greek Black Pig



Greek Black Pig





Promotion



MC1R (melanocortin receptor type 1) - 1



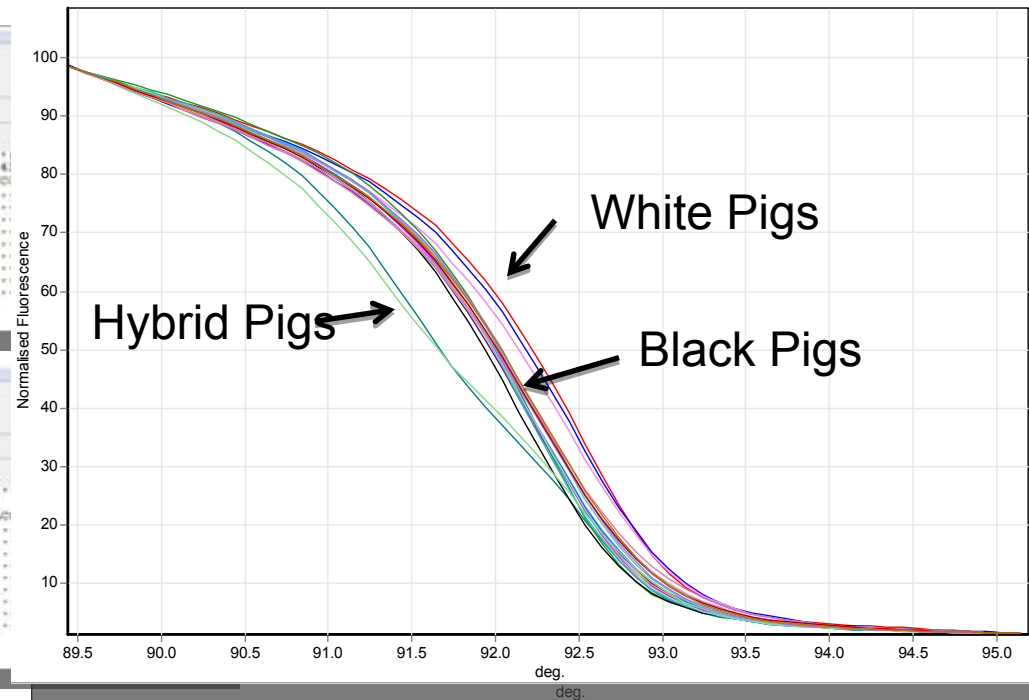
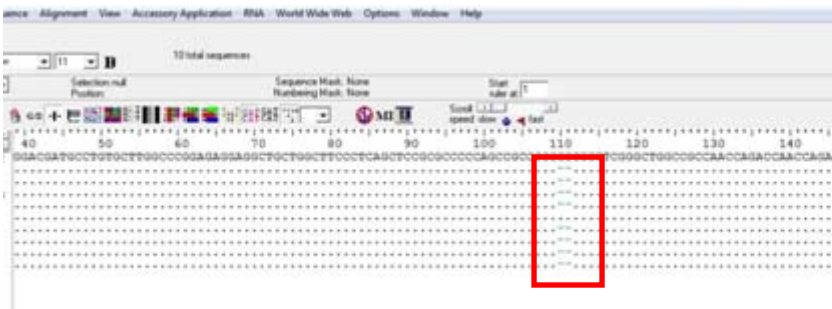
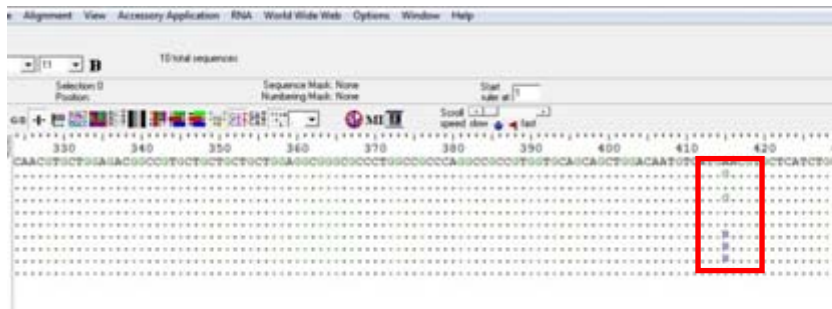
San Daniele

30 Euros/Kg

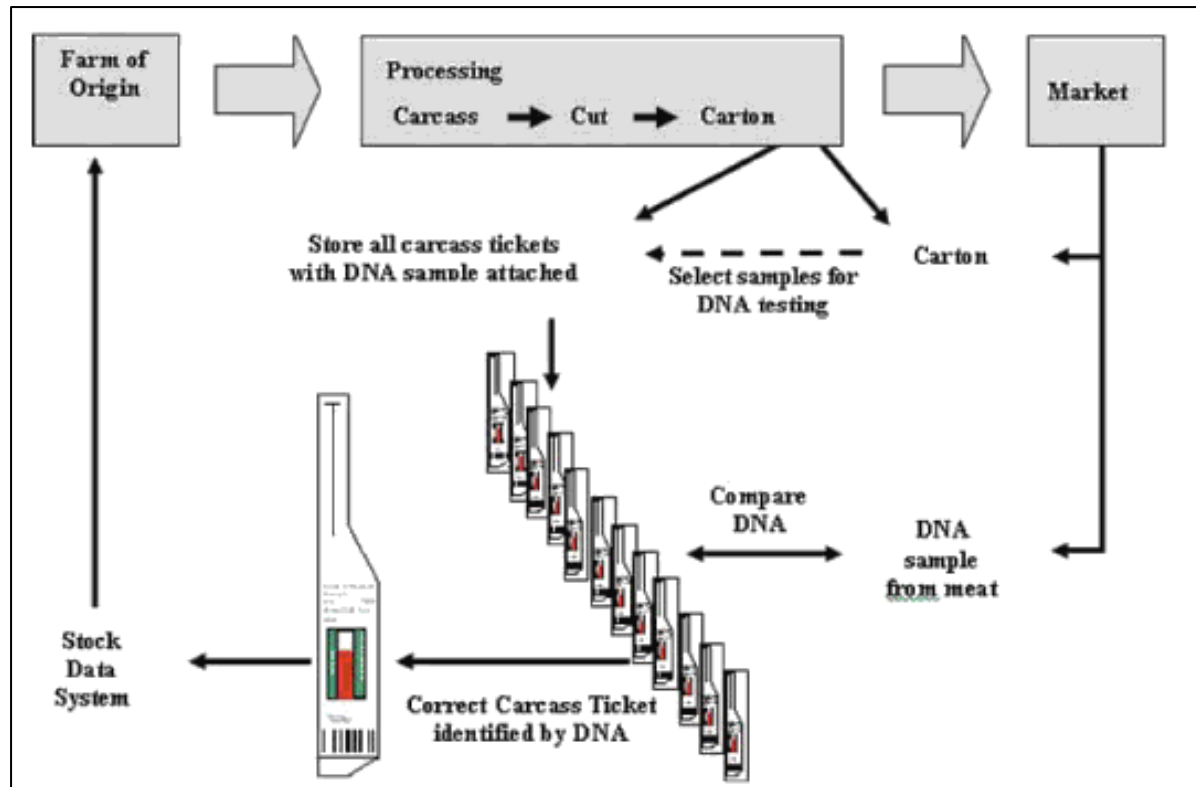


Pata Negra Bellota

150 Euros/Kg



DNA Traceability



Traceability

- DNA certified products of animal and plant origin
 - Unique «DNA signature»
 - Protection form adulteration and fraudulent actions
 - Could protect the added valued of PDO and PGI products
 - Protection of the investment made from the stakeholders
 - **Some Examples:** Mozzarella di buffala, Feta Cheese, Greek Black Pig, Fava Santorinis etc.

Greek Feta Cheese



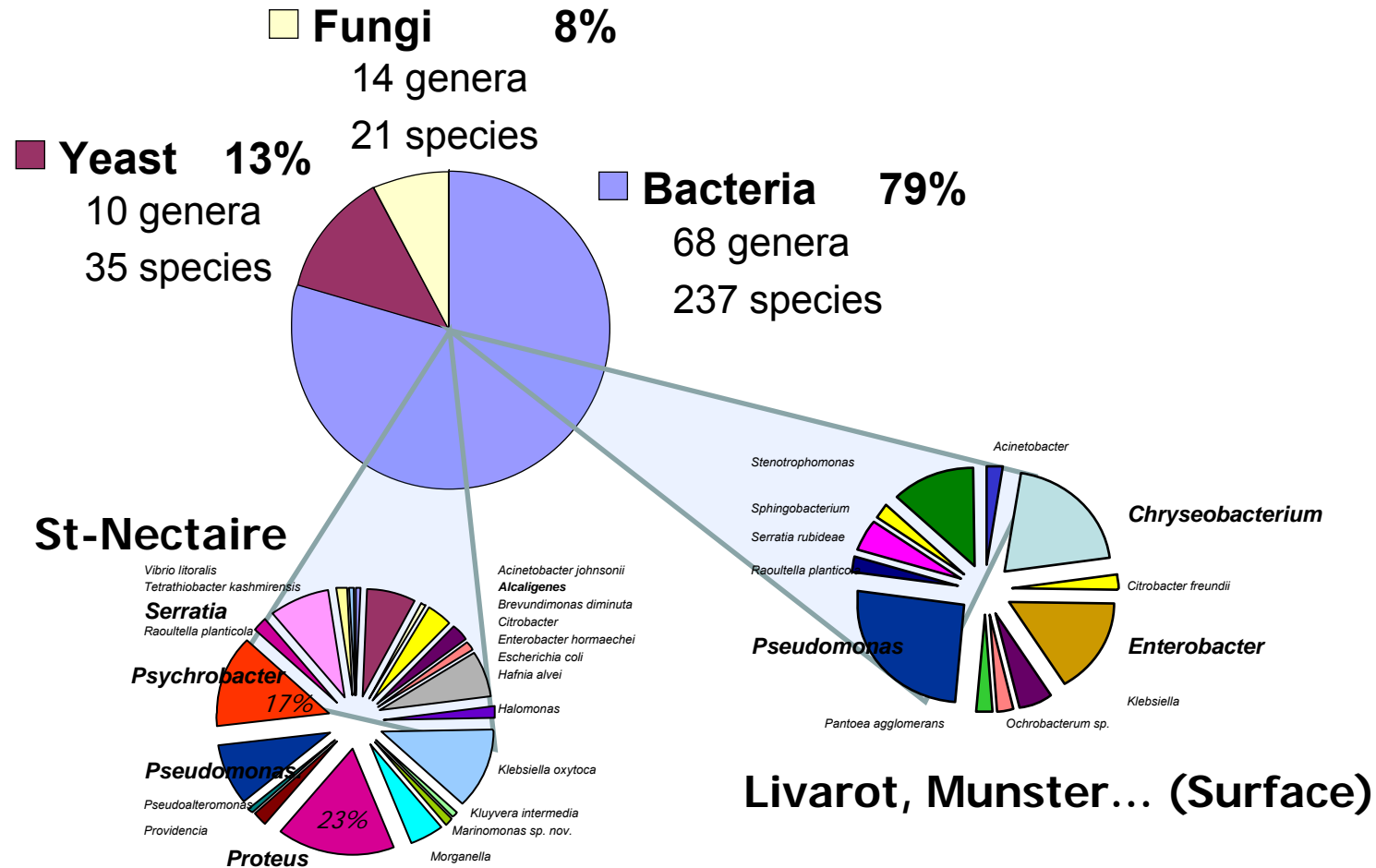
- + Only Sheep and Goat milk
- + Max goat milk to 30%
- It is prohibited to manufacture Feta Cheese from other type of milk.



high-throughput sequencing technologies to certify cheeses



Microbial diversity of traditional cheeses



Ref: MC Montel, ANR GRAMME 2008-2010

Greek PDO Cheeses



Conclusions

Need to conserve and valorize local animal races

Coordinated projects for the genetic improvement supported by new technologies

Create pure livestock free of diseases, adapted to the Greek conditions

Actions to certify, characterize, valorize traditional products.

Development of New Products

Reinforce and Protect the Greek Brand Name

Need to cooperate and collaborate research Institutions and the stakeholders

Σας Ευχαριστώ

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