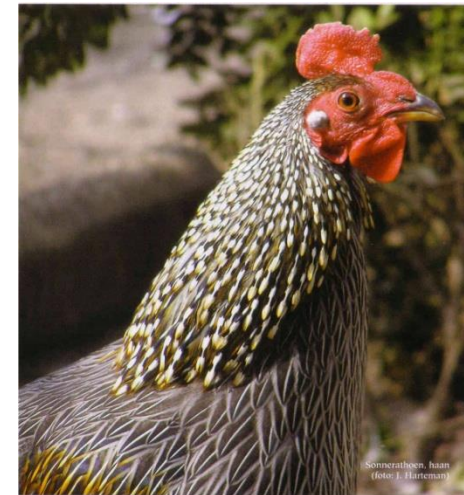
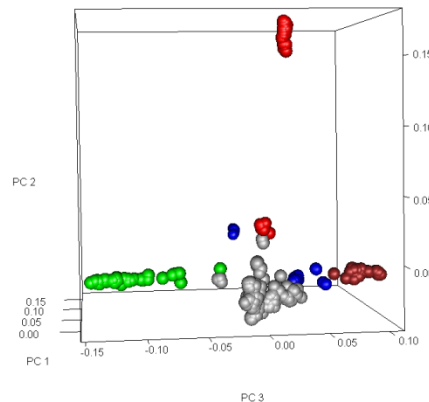


Cosmopolitan Chicken Research Project - CCRP

Seminar by Peter Konings (ESAT) and Ellen Ons (Biosystems)



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The Cosmopolitan Chicken Project – Koen Vanmechelen

On the origin of chickens: Jungle Fowl

Aims and sampling

Experimental work

Blood collection, DNA-isolation, SNP chip

Quality Control

Principal Component Analysis

Genetic diversity

Discussion and perspectives

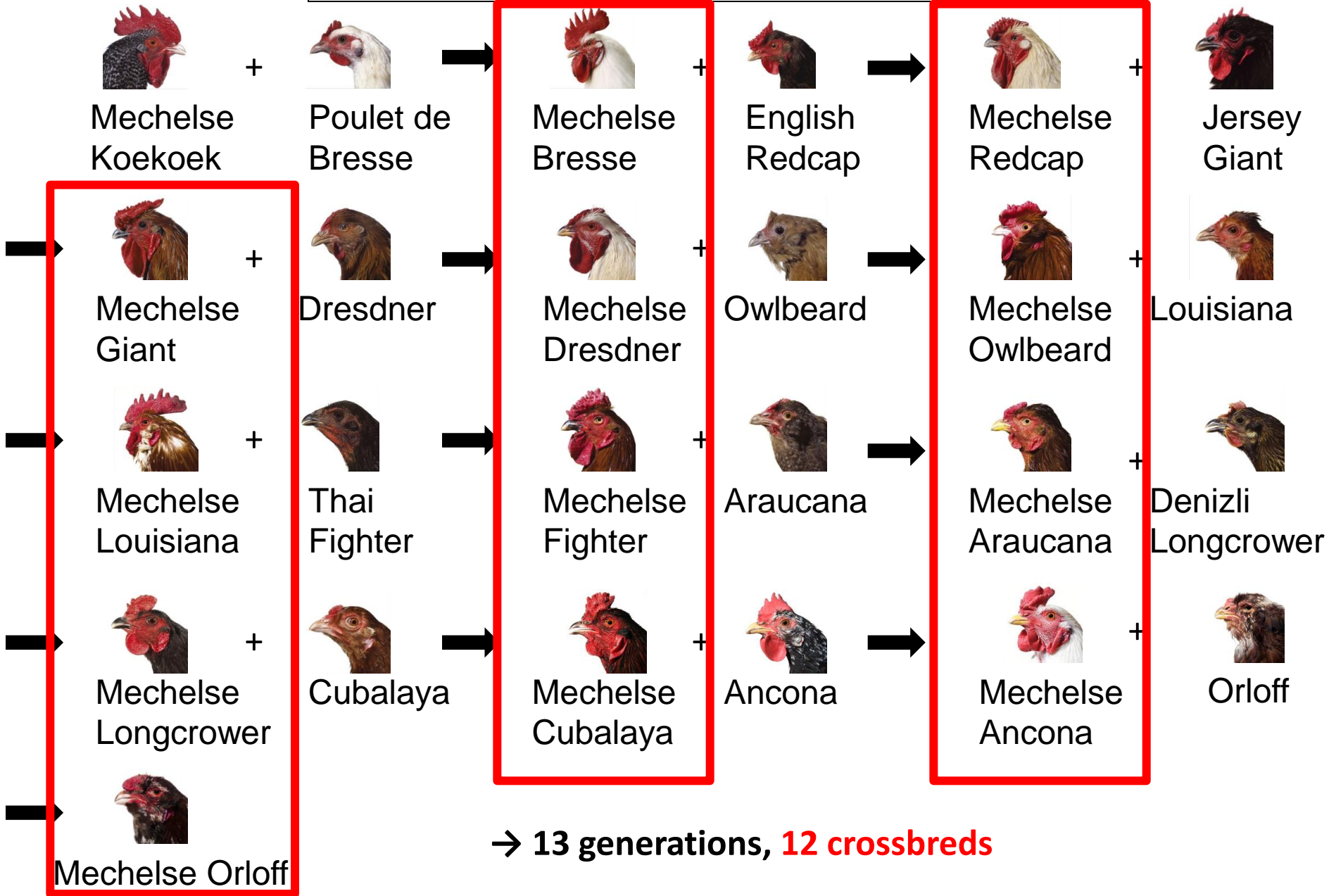
Art project KOEN VANMECHELEN



© Koen Vanmechelen

Creation of the **Cosmopolitan Chicken** since 1990

Art project KOEN VANMECHELEN



Origin?

Domestic chickens



...



Cosmopolitan Chicken

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Jungle Fowl

4 species:

Red Jungle Fowl – *Gallus gallus*

5 subspecies:

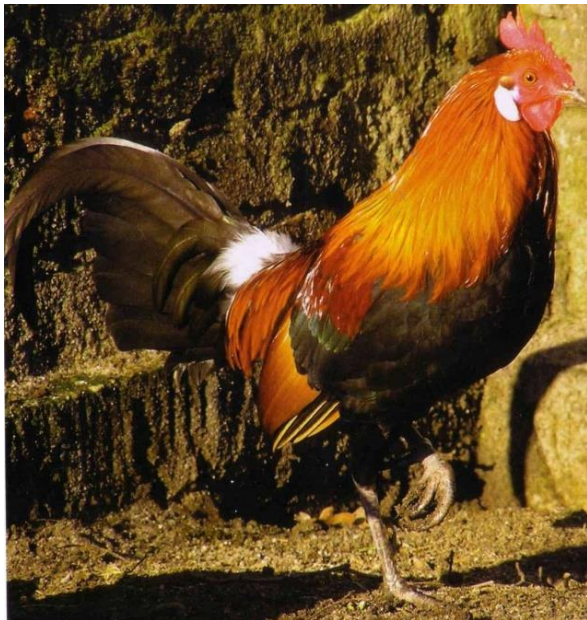
Gallus gallus gallus

Gallus gallus spadiceus

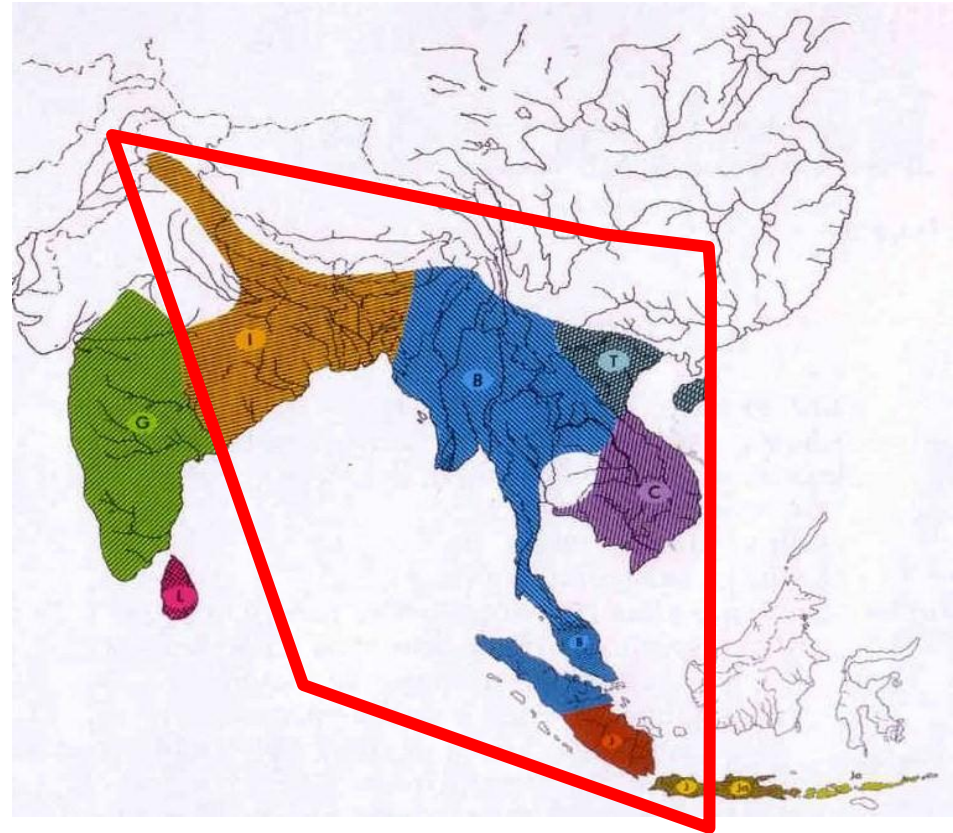
Gallus gallus murghi

Gallus gallus jabouillei

Gallus gallus bankiva



© J. Harteman



First chicken genome sequenced (2004)

Phylogenetic analysis (mtDNA, CR1, OTC)

→ **Most important ancestor of domestic chickens**

Jungle Fowl

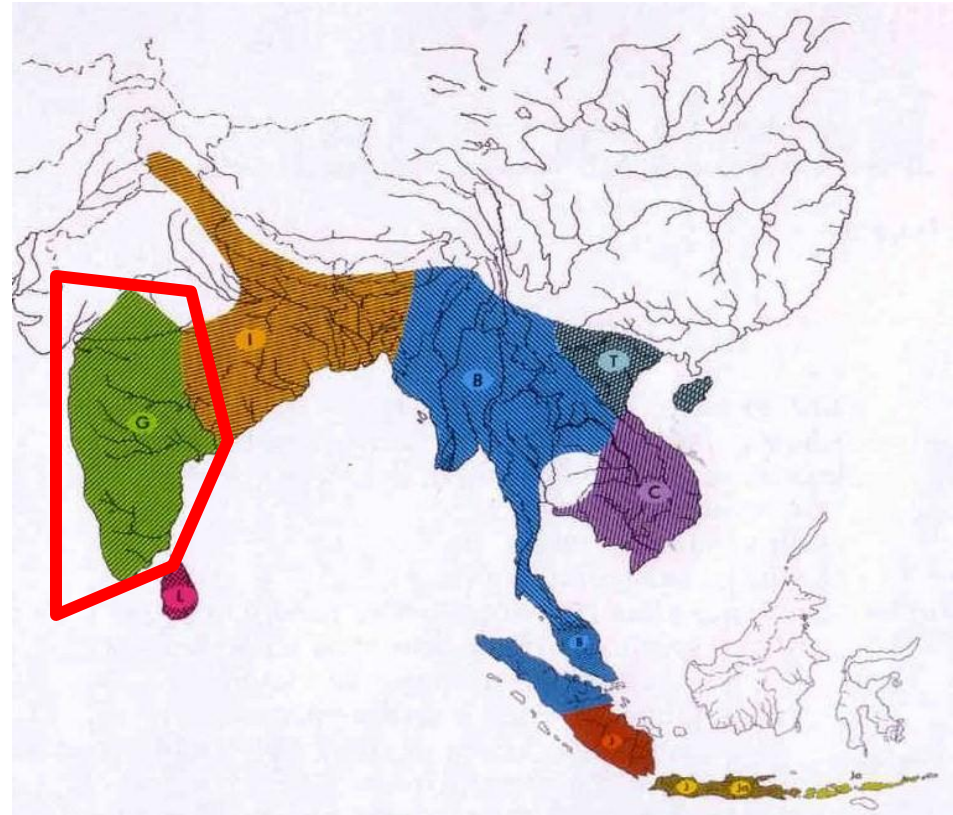
4 species:

Red Jungle Fowl – *Gallus gallus*

Grey Jungle Fowl – *Gallus sonneratii*



© J. Harteman



Phylogenetic analysis (*yellow skin*)

→ **Cofounder of domestic chickens**

Identification of the *Yellow Skin* Gene Reveals a Hybrid Origin of the Domestic Chicken

Jonas Eriksson¹, Greger Larson¹, Ulrika Gunnarsson¹, Bertrand Bed'hom², Michele Tixier-Boichard², Lina Strömstedt³, Dominic Wright¹, Annemieke Jungerius⁴, Addie Vereijken⁴, Ettore Randi⁵, Per Jensen⁶, Leif Andersson^{1,3*}

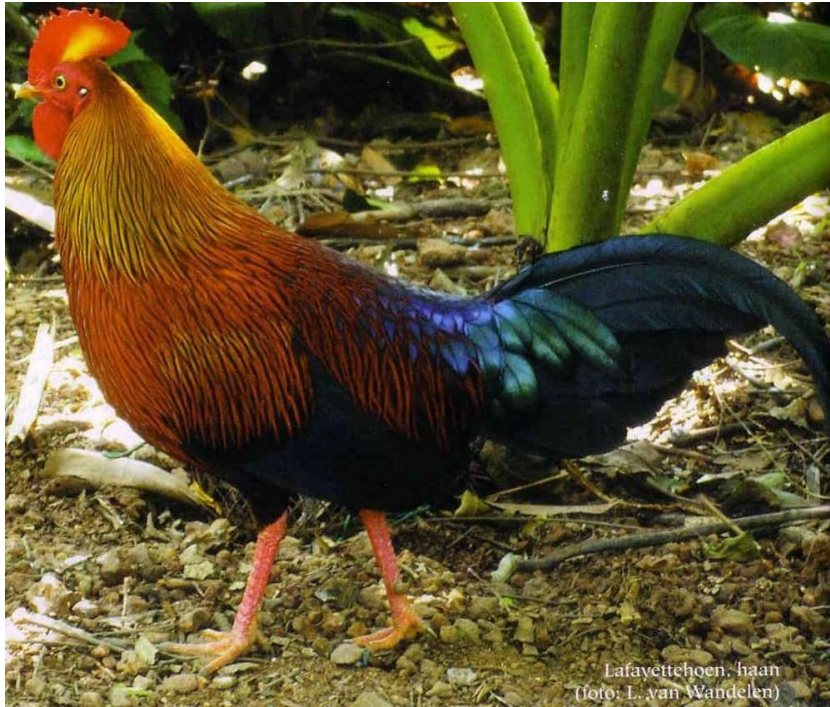
Jungle Fowl

4 species:

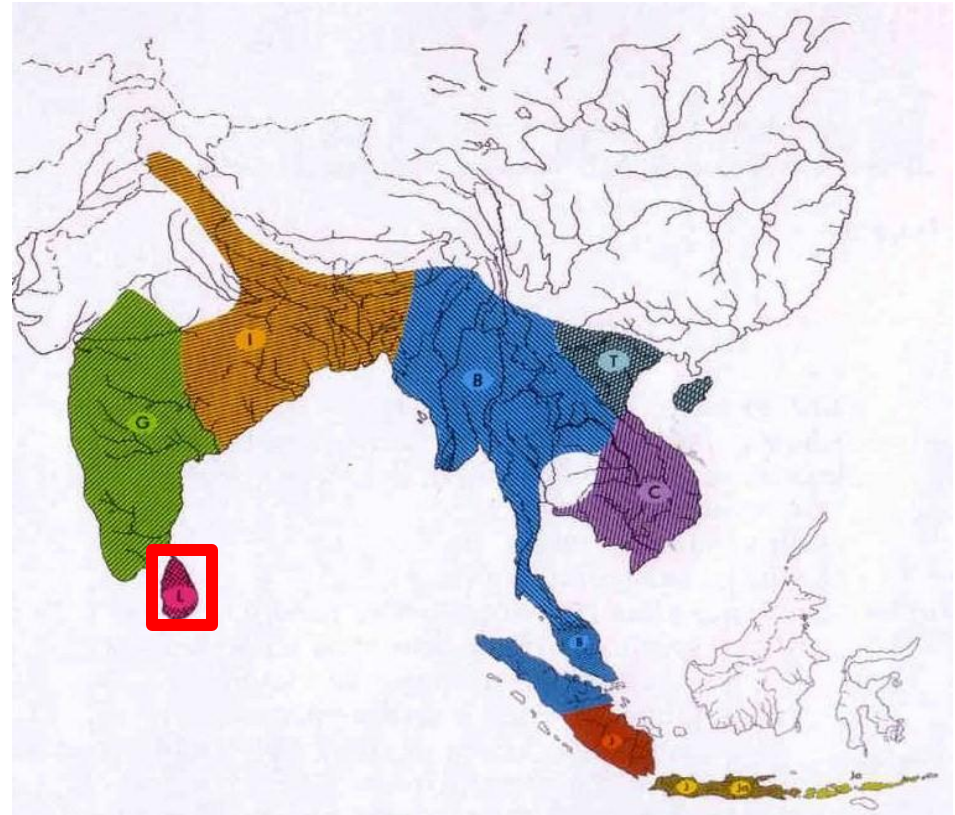
Red Jungle Fowl – *Gallus gallus*

Grey Jungle Fowl – *Gallus sonneratii*

Yellow Jungle Fowl – *Gallus lafayettii*



Lafayettehoen, haan
(foto: L. van Wandelen)



Jungle Fowl

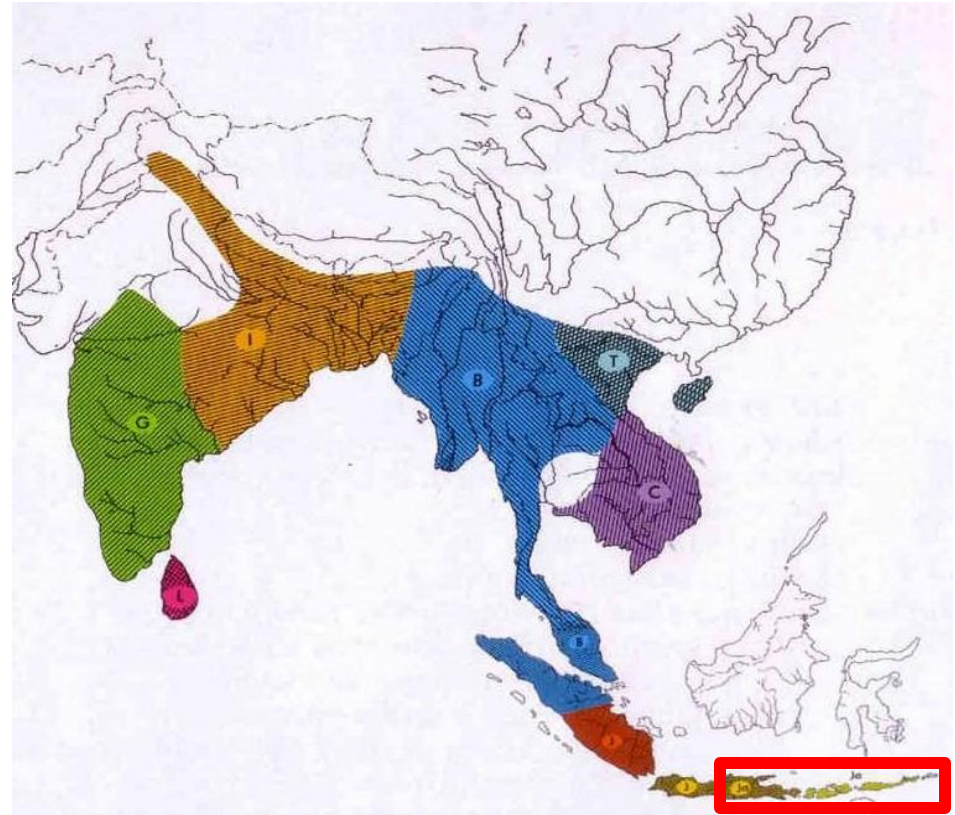
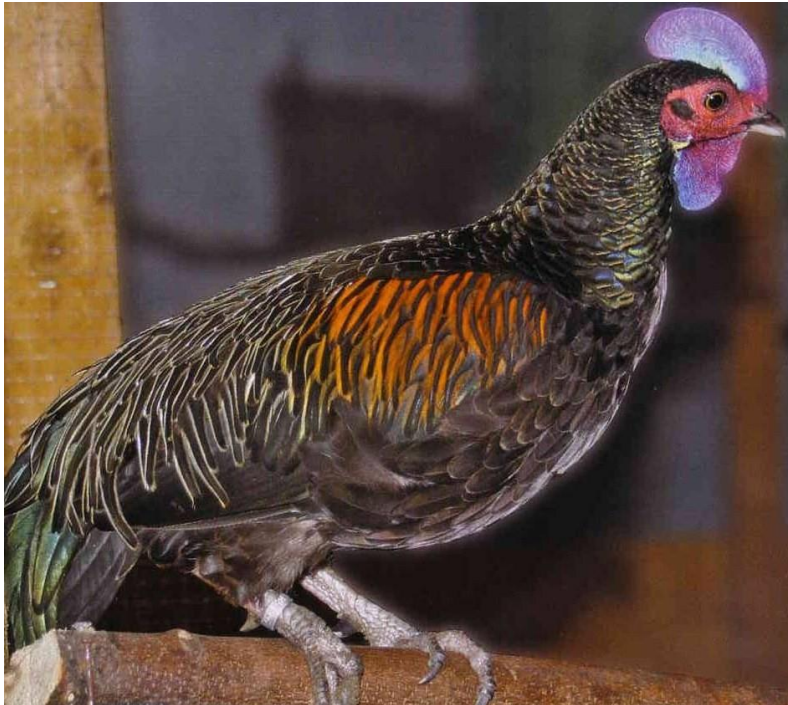
4 species:

Red Jungle Fowl – *Gallus gallus*

Grey Jungle Fowl – *Gallus sonneratii*

Yellow Jungle Fowl – *Gallus lafayettii*

Green Jungle Fowl – *Gallus varius*



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Aims

1. How genetically diverse are chicken breeds?

→ Investigation of 5 chicken breeds from different breeders



Shamo

5 breeders
42 birds



Poulet de Bresse

5 breeders
34 birds



Orpington

5 breeders
39 birds



Mechelse Koekoek

5 breeders
35 birds



Araucana

6 breeders
43 birds

Aims

1. How genetically diverse are chicken breeds?

→ Investigation of 5 chicken breeds from different breeders

→ **Investigation of the original breeds from Koen Vanmechelen**

Mechelse Koekoek	7	Denizli Longcrower	2
Poulet de Bresse	13	Cubalaya	8
English Redcap	3	Ancona	10
Jersey Giant	7	Russische Orloff	4
Dresdner hühn	2	Shamo	1
Owlbeard	5	Orpington	1
Louisiana	3		
Araucana	3		

Aims

1. How genetically diverse are chicken breeds?
2. **What are the effects of crossbreeding on genotype?**

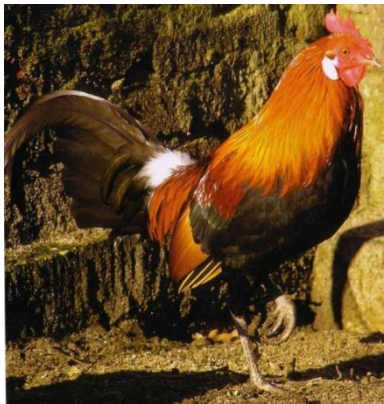
→ Investigation of the crossbreeds from Koen Vanmechelen

Mechelse Bresse	5	Mechelse Fighter	8
Mechelse Giant	1	Mechelse Araucana	11
Mechelse Dresdner	1	Mechelse Longcrown	11
Mechelse Owlbeard	8	Mechelse Cubalaya	10
Mechelse Louisiana	7	Mechelse Ancona	10

Aims

1. How genetically diverse are chicken breeds?
2. What are the effects of crossbreeding on genotype?
3. How does Jungle Fowl relate to domestic chickens/to crossbreds?

→ Investigation of the 4 types of Jungle Fowl



Red Jungle Fowl

G. g. gallus 2



Grey Jungle Fowl

2 birds



Yellow Jungle Fowl

2 birds



Green Jungle Fowl

2 birds

G. a. jabouillei 2

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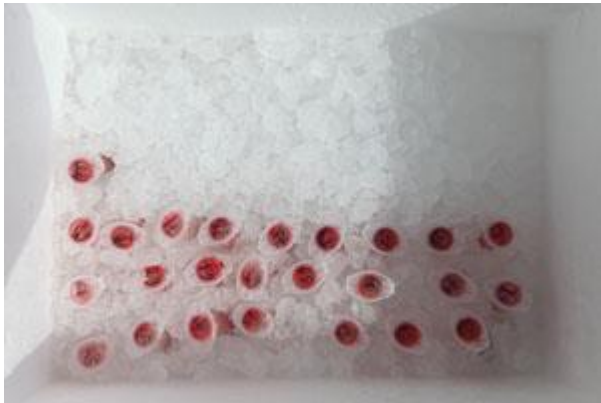
Discussion and perspectives

SNP chip

Blood collection

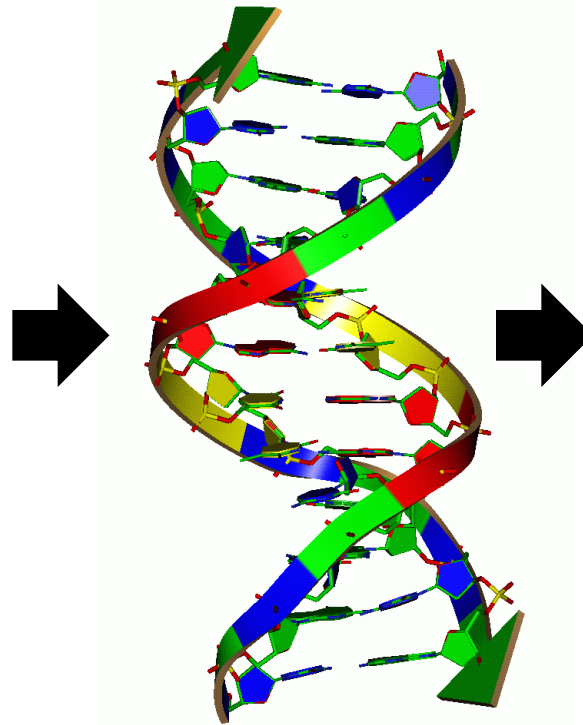


© Koen Vanmechelen



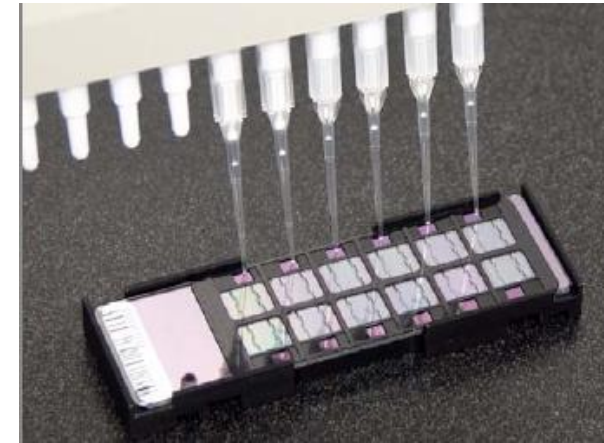
EDTA
Cooled on ice,
frozen upon arrival

DNA extraction



Phenol-chloroform
extraction

SNP chip



© Illumina

Infinium HD iSelect
Custom BeadChip
(Illumina)

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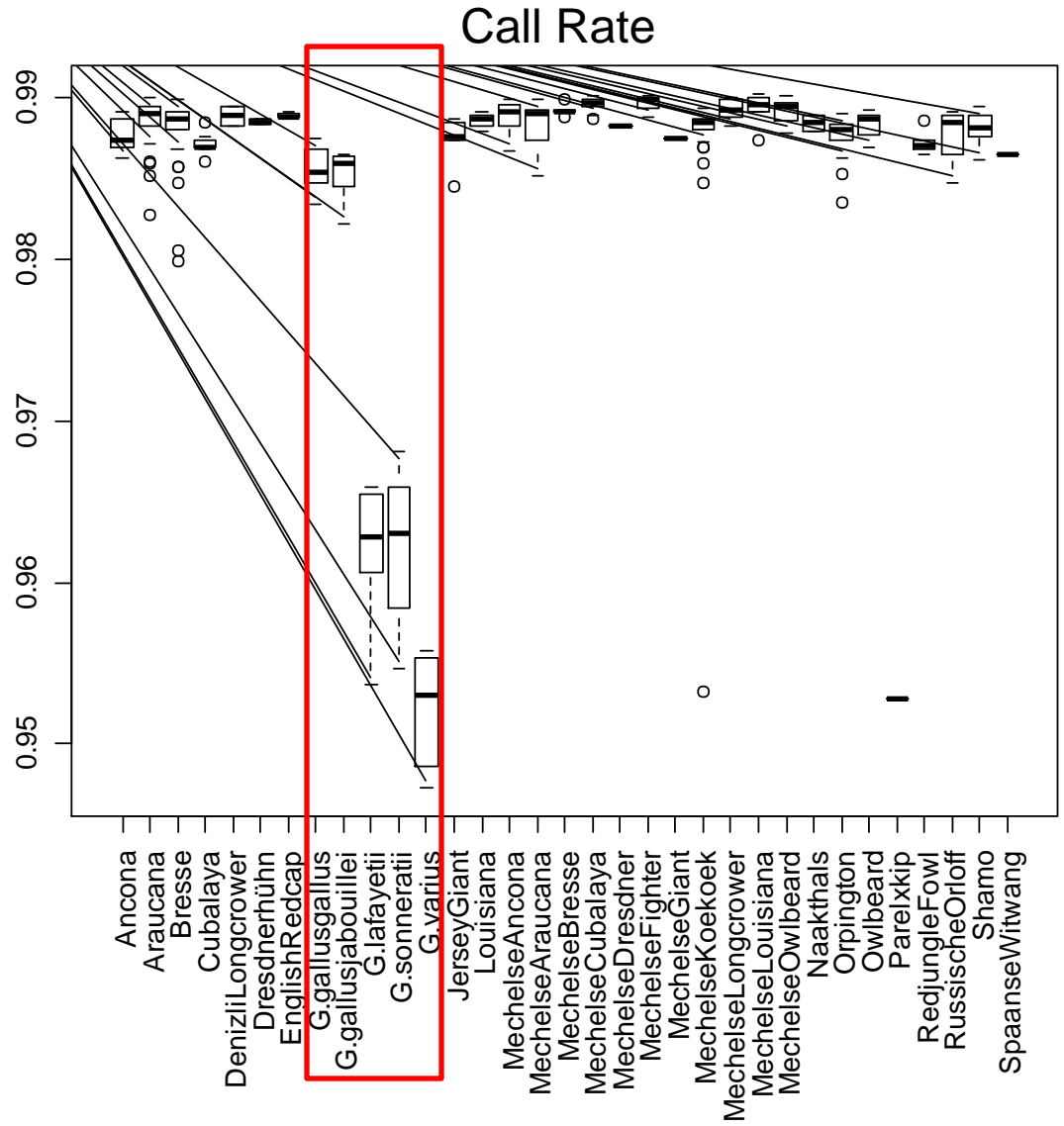
Quality Control

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Quality Control



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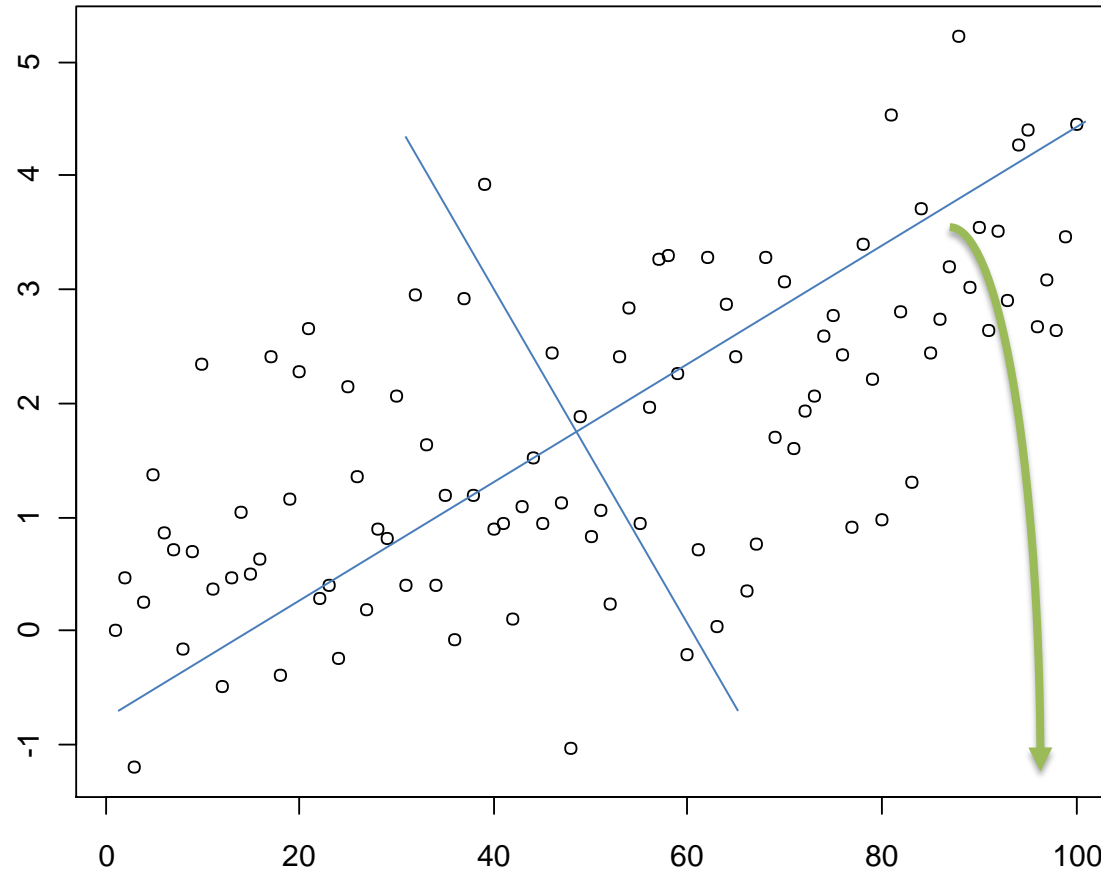
Quality Control

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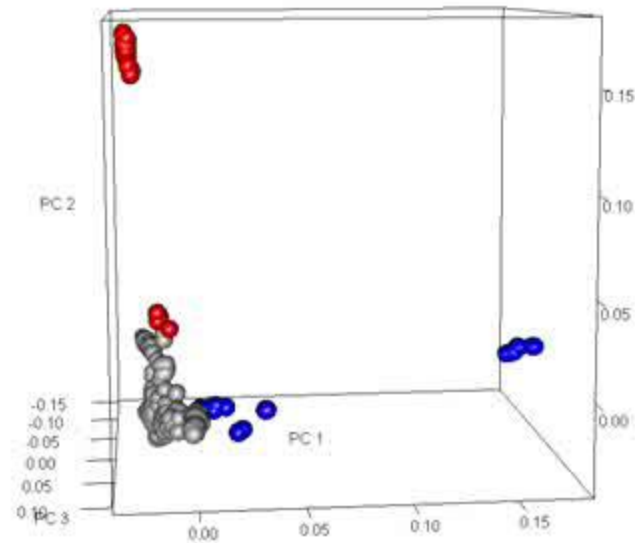
Genetic diversity

Discussion and perspectives

Principal Component Analysis



PCA discriminates purebreds



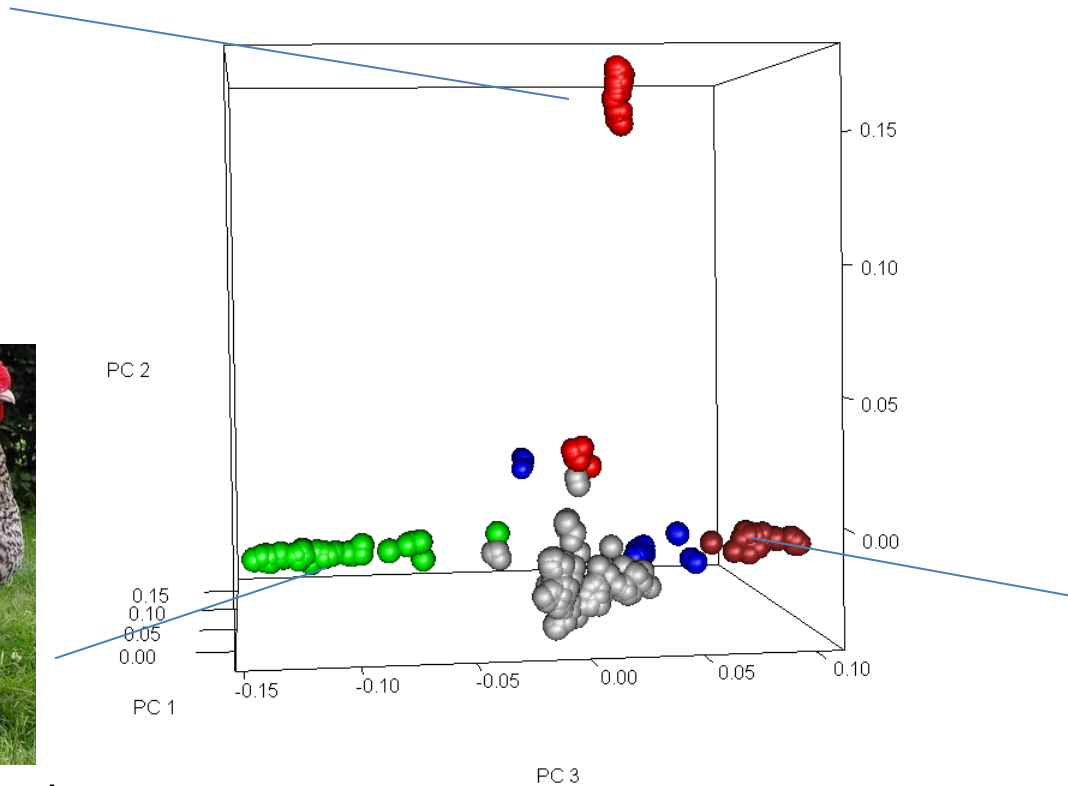
PCA discriminates purebreds (2)



Orpington



Mechelse Koekoek



Shamo

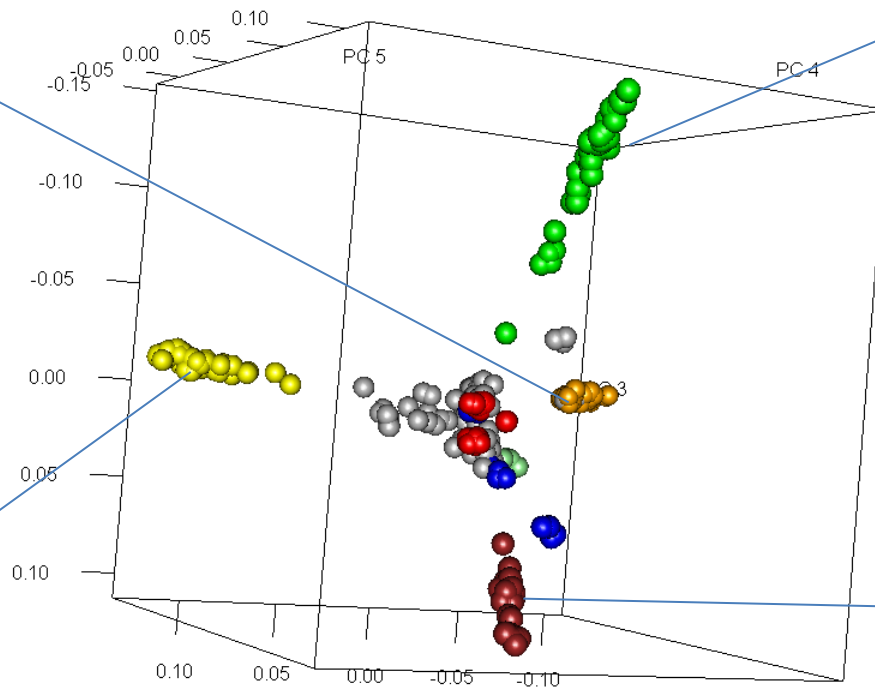
PCA discriminates purebreds (3)



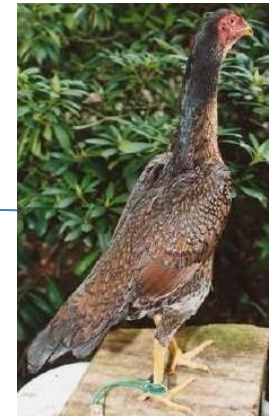
Bresse



Mechelse Koekoek



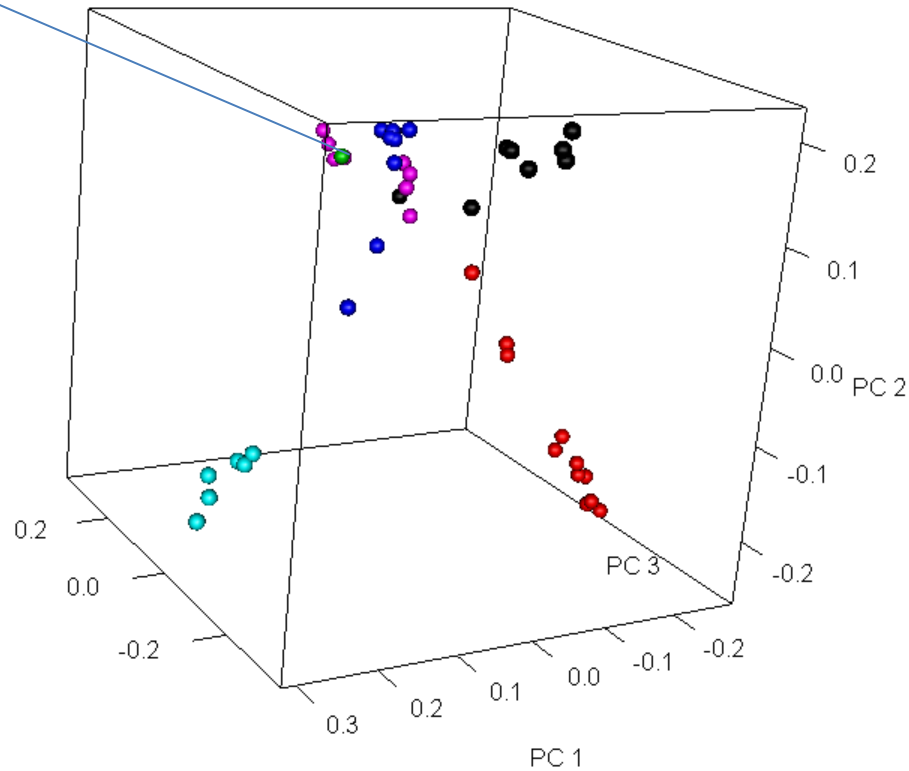
Araucana



Shamo

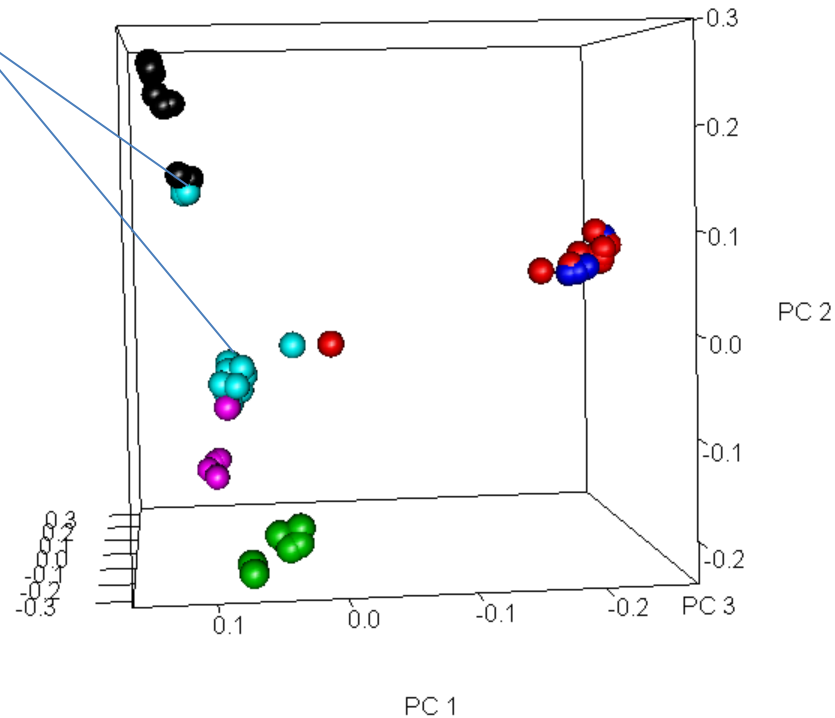
PCA discriminates Shamo breeders

KVM's Shamo (1)



PCA discriminates Bresse breeders

KVM's Bresse (14)



Crossbreds

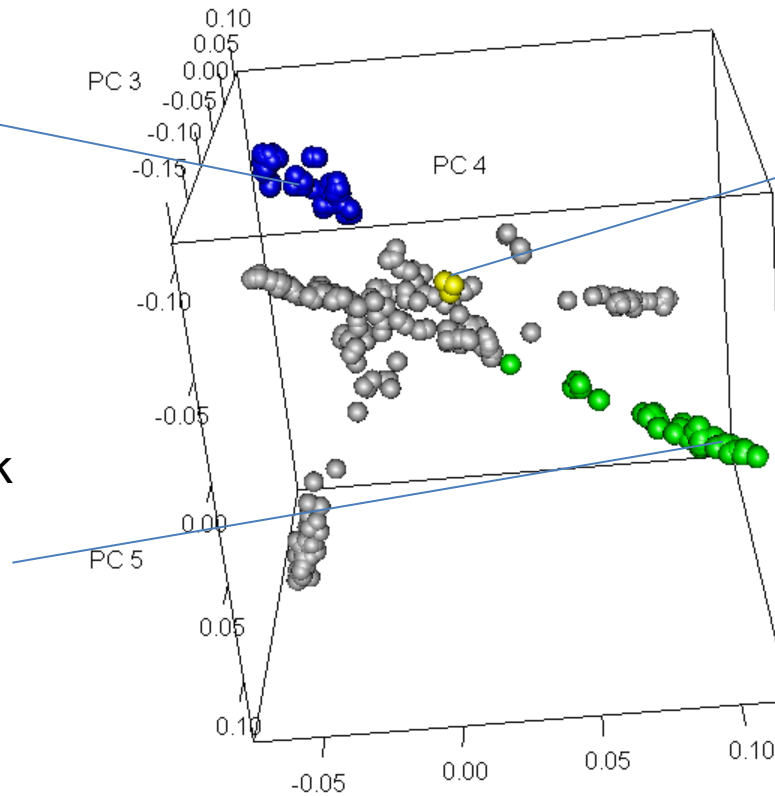
Bresse



Mechelse Bresse



Mechelse Koekoek



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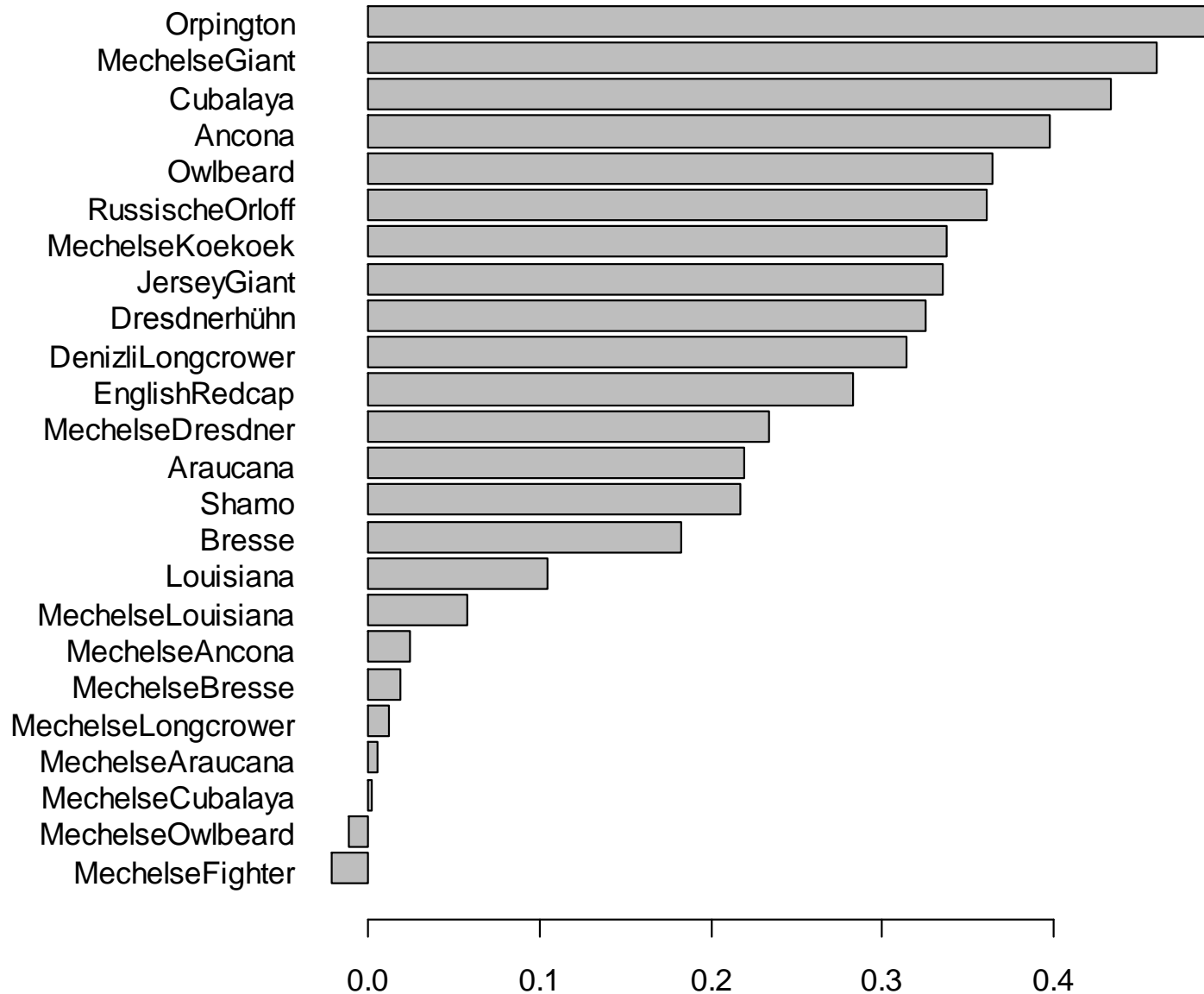
Quality Control

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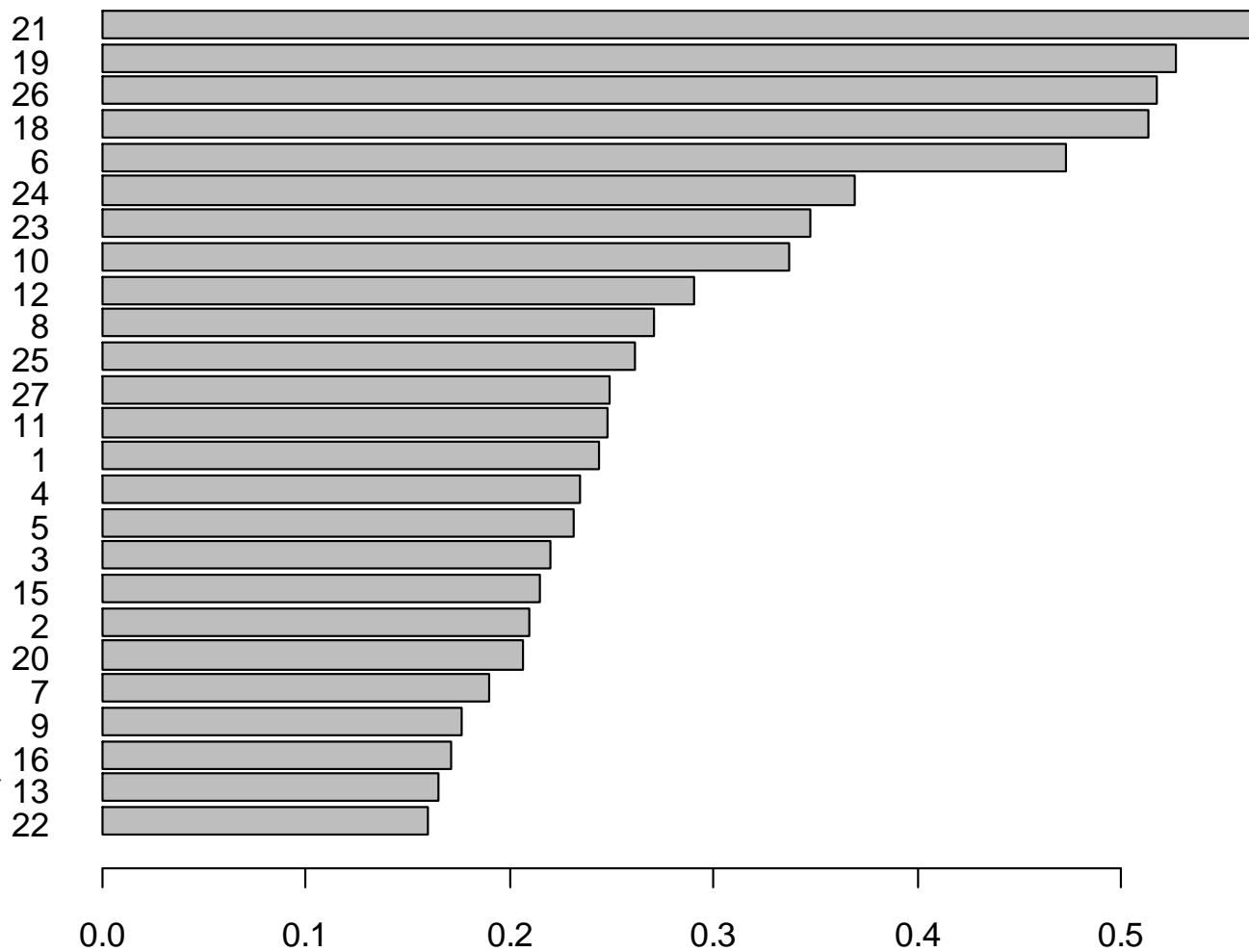
Genetic diversity

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Inbreeding



Inbreeding by breeder



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Discussion + Perspective

- Data quality ok
- Differentiation possible between purebreds, crossbreds and breeders
- Genetic diversity

Discussion (2)

- Red Jungle Fowl closest to chicken
- Future work:
 - More jungle fowl
 - Phylogeny
 - Copy Number Variants?

Acknowledgements

- Koen van Mechelen
- Breeders
- Professors Cassiman, Goddeeris, Buys, Marynen, Moreau & Cuppens
- Alfredo de Gregorio
- Tom Luyten
- Ruben Boonen
- Jeroen Huyghe
- Marcel Samain