RESPONSE TO SELECTION FOR *orylag* ® FUR PRODUCTION TRAITS ESTIMATED BY USING A CONTROL CRYOPRESERVED POPULATION

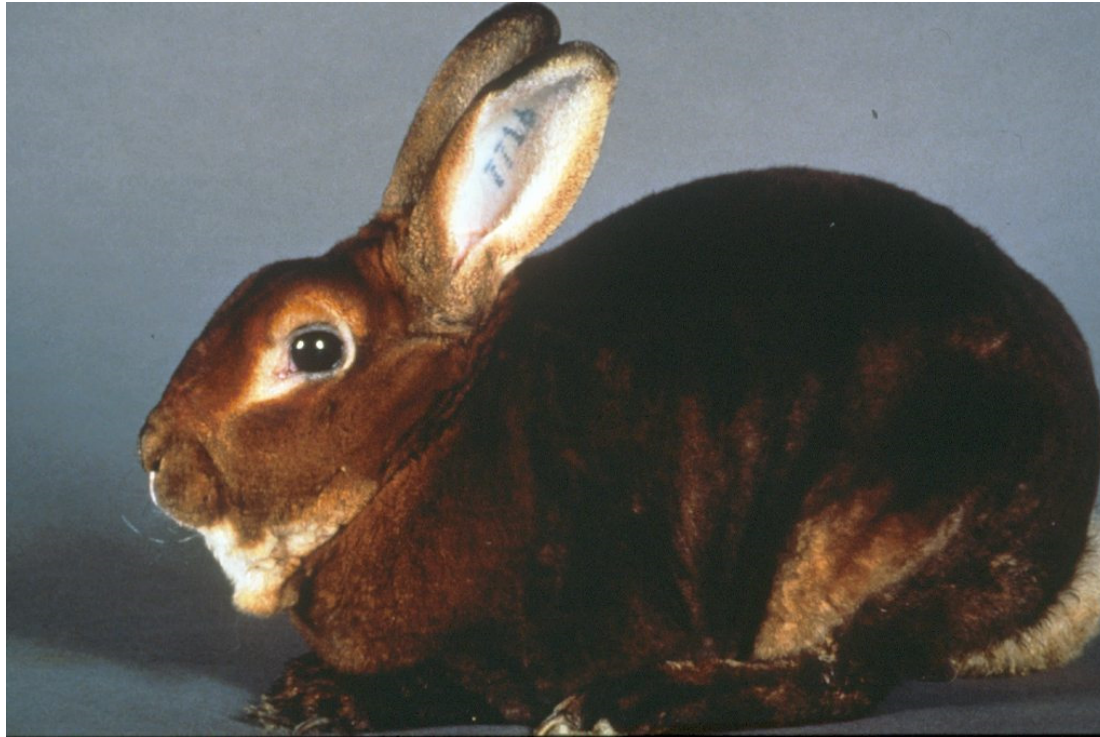D. Allain. G. Auvinet[2]. S. Deretz[2]

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EAAP 2014 – session 36 : Fur, Fibre and skin animal products

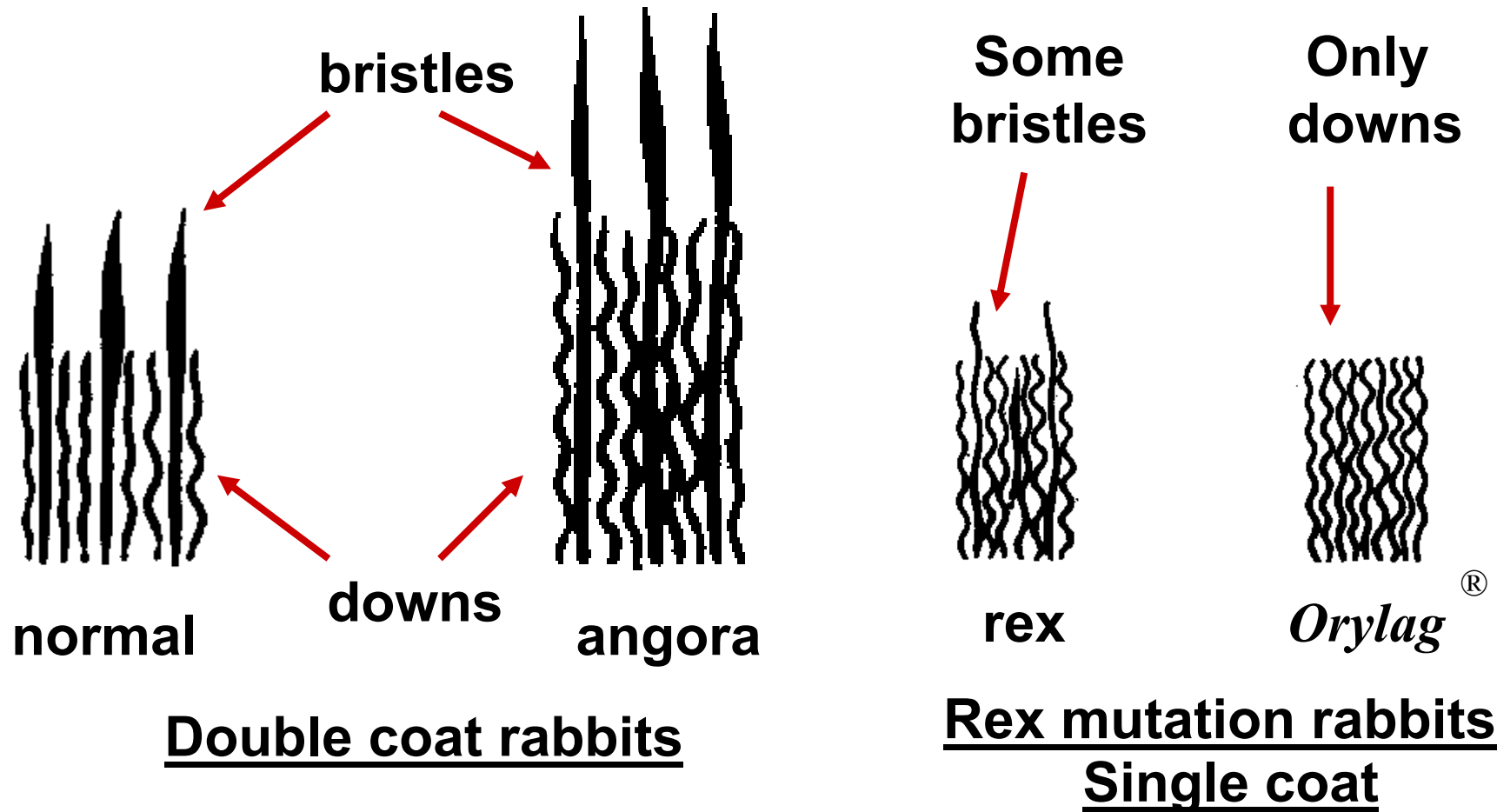27/ 08 / 2014

orylag ®

Source : R.G. Thebault & D. Allain

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## A dual purpose animal derived from the Rex rabbit for both meat and fur production

Composition and structure of different coats in rabbits

bristles

Some bristles

Only downs

downs

normal

angora

rex

Orylag®

Double coat rabbits

Rex mutation rabbits
Single coat

Functionning of primary hair follicles in the Rex mutation rabbit
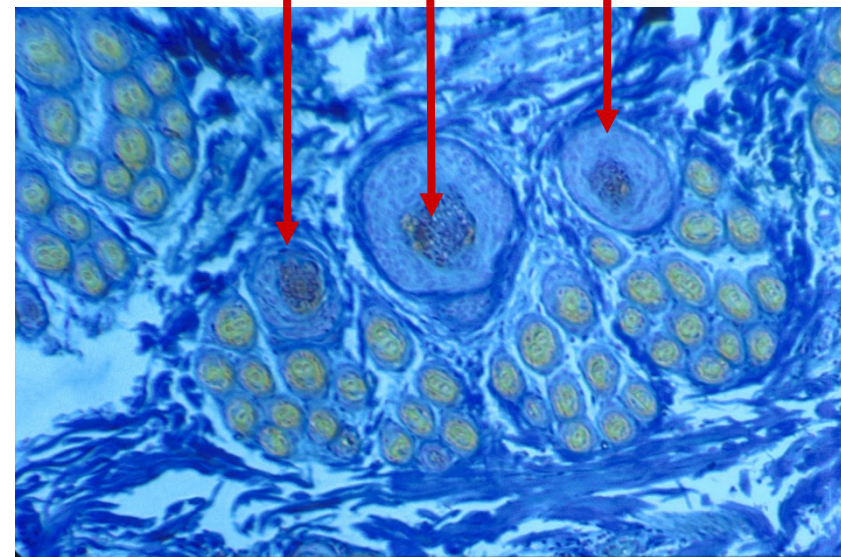
Normal hair rabbit

Primary hair follicles are producing guard and coarse hair
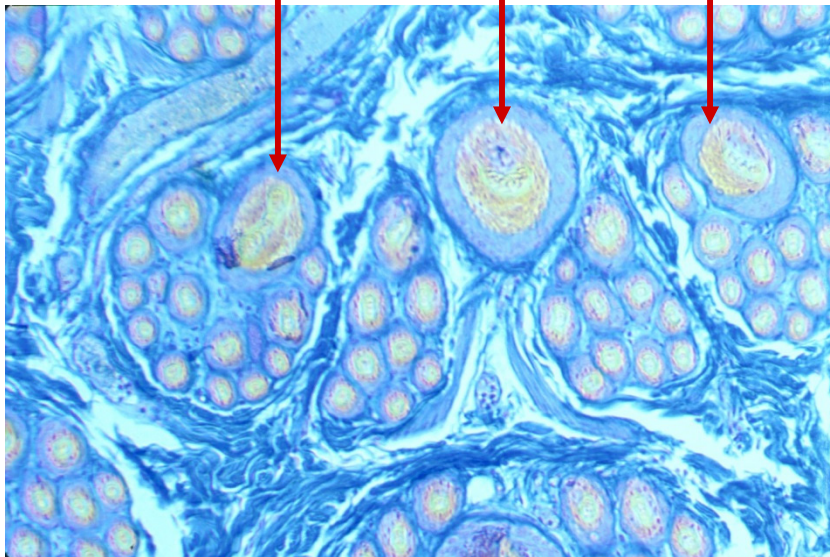
Source : R.G. Thebault & D. Allain

Rex mutation rabbit

Degeneration of primary hair follicles

Source : R.G. Thebault & D. Allain

A deletion in exon 9 of the LIPH gene is responsible of rex phenotype

(Diribarne et al 2011, 2012)

Genetic improvement of *orylag* ® for fur production

Closed selected nucleus

- 100 animals
  - Castor type

- 8 Separate mating groups
- Overlapping generations

Selected traits

- Live body weight at 16 weeks
- Hair length

Hair length measurement

ruler

Genetic improvement of *orylag* ® for fur production

Closed selected nucleus

- 100 animals castor strain

- Separate mating groups
- Overlapping generations

Selected traits

- Live body weight at 16 weeks
- Hair length

- **Fur compactness**

Fur compactness measurement

compacimeter

Genetic improvement of *orylag* ® for fur production

Closed selected nucleus

- 100 animals
    - Castor type

- 8 Separate mating groups
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Selected traits

- Live body weight at 16 weeks
- Hair length
- Fur compactness
- **Scoring**
    - ➢**Bristlyness** or hairiness

Bristlyness or hairiness scoring

On 3 body area
- mid back
- rump
- base of tail

Total score :
sum of scores

Many guard hair

No guard hair

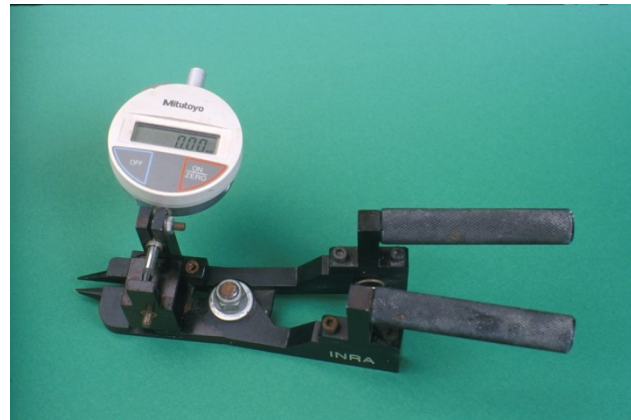# Genetic improvement of *orylag* ® for fur production

Closed selected nucleus

- 100 animals
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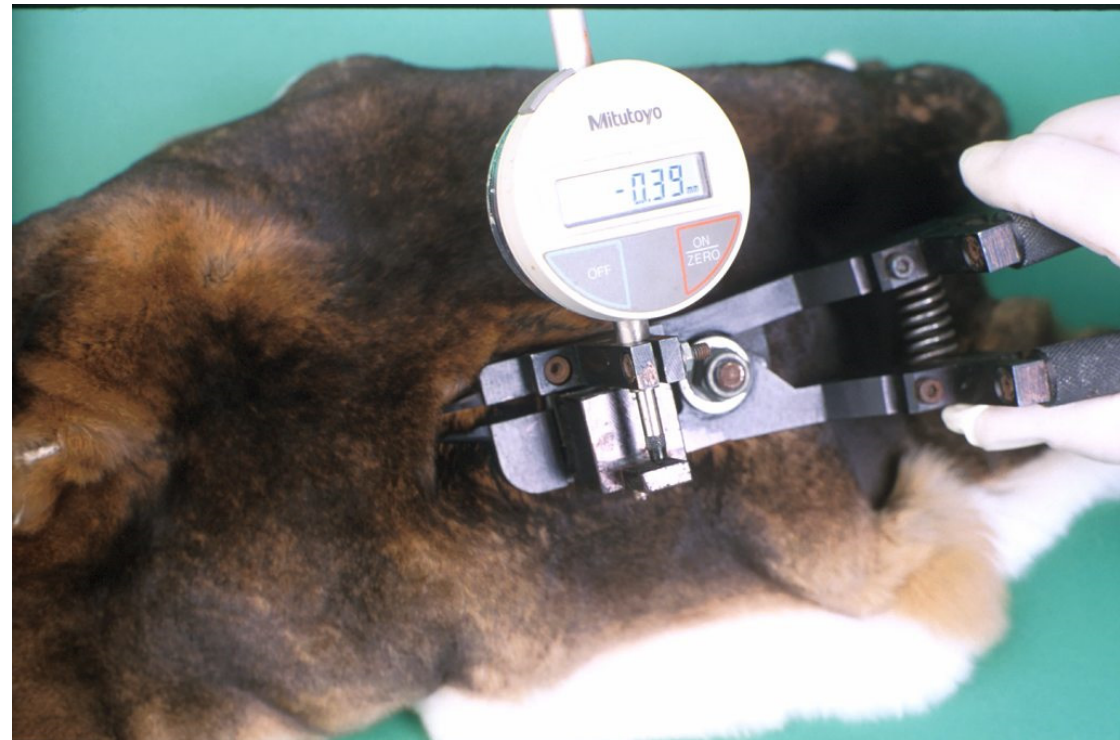
- Separate mating groups
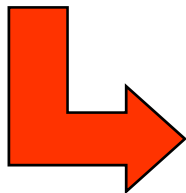- Overlapping generations

Selected traits

- Live body weight at 16 weeks
- Hair length
- Fur compactness
- Scoring
  - Bristlyness or hairiness
  - **Fur priming**
    - **Blue pigmentation of skin over the body :**
      - mid-side & mid-thigh
    - **Total score**

Genetic improvement of *orylag* ® for fur production

Closed selected nucleus

- 100 animals
  - Castor strain
- Separate mating groups
- Overlapping generations

BLUP evaluation of breeding values from 1994
Global multitrait index

Selected traits

- Live body weight at 16 weeks
- Hair length
- Fur compactness
- Scoring
  - Bristlyness or hairiness
  - fur priming

Genetic dissemination within CEO the *orylag* ® breeder organisation

Response to selection
Experimental context

- Use of a cryoconserved population to measure response to selection for $orylag^{\circledR}$ fur traits in the selection nucleus

- From the selected population
  - 1995 :creation of a control population with collection of embyos for cryoconservation
  - 2004: embryo defrosting and transfer to receiving does
    - to produce about 100 offsprings of a control population
    - to be compared to offspring of the selected population

- 2005: comparaison of offspring of both control and selected population

Experimental design

1989

Control population

1995 → Collection of 391 embryos for cryoconservation

Selected population on fur traits

347 embryos thawed and transferred

2004

2005   2005

~100 offsprings   ~100 offsprings

Response to selection

2014
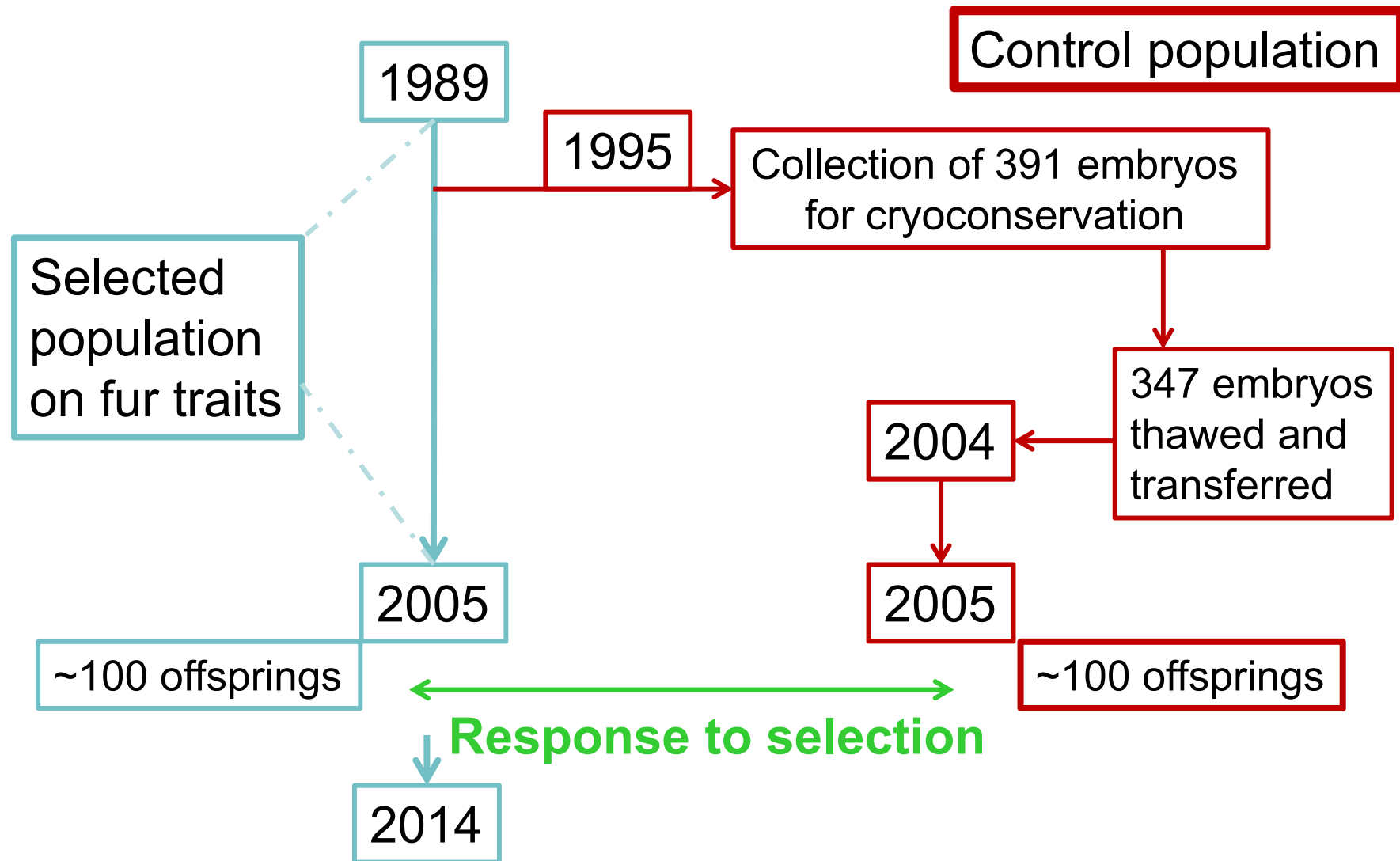
Control population
Embryo and reproduction data

1995 - Embryo collection	391 embryos from 64 donnor does and 8 males (1 male / each mating group)
2005 - Embryo transfert	347 defrosted embryos transfered to 40 receiving does
Reproduction results after transfert	20 pregnant does 57 born alived , 53 weaned (issued from 7/8 mating groups : 1 group lost)
Animals kept as breeders	18 males and 13 females
Offspring production	All 13 does & 18 males used for reproduction (AI) 3 reproductive cycle / does at 6 week intervall → estimate response to selection 3 additionnal reproductive cycles → creation 50does → new embryo stock for latter studies

Data analysis

1. Gene probability origin
   - Control and selected population

2. Response to selection
   - Control and selected population

3. Genetic parameters and genetic trends
   - Nucleus population

Data analysis 1/3
Gene origin probabilities

- Pedigree data
  - Whole nucleus population from 1989 to 2005 (n =39,545)
  - Control (n=87) and select (n=113) groups

- Pedigree analysis using Pedig
  - (https://qgsp.jouy.inra.fr/)
  - total and effective founders / population
  - Gene origin probabilities / population
  - :

  → Gene origin probabilities in both
  - control group (cryopreserved embryos)
  - selected group

Gene origin probabilities

Gene origin probabilities were close similar between selected and control populations despite low reproductive results after embryo transfer

Male	Selected population	Control population
Total founders (n=)	36	34
Effective founders (n=)	16.8	15.9
Ancestors (n=) → 75% gene origin	12	10
Female		
Total founders (n=)	36	34
Effective founders (n=)	16.8	15.7
Ancestors (n=) → 75% gene origin	12	8

Cryopreserved population = good tool to preserved genetic diversity

Data analysis 2 / 3 response to selection

- Experimental population
    - Selected group (n=113) and control group (n=87)

- Traits measured at 16 w of age
    - Bristlyness or hairiness, fur compactness, fur priming, hair length and live weight

- Analysis : mixed model using AsReml
    - Fixed effects: sex, birth batch, litter size, age of dam, **selection group**
    - Random effects: animal, permanent litter environment, residual
    - With information of all generations and complete relationship matrix

→ Contrast between selected group and control group (cryopreserved embryos)

Data analysis 3 / 3
genetic trends, genetic parameters

- Traits measured at 16 w of age
  - Bristlyness, fur compactness, fur priming, hair length , live weight

- Whole animal population from 1989
  - Pedigree file :n= 48,377
  - Data file : n= 43,784

- Genetic analysis : mixed model using AsReml
  - Fixed effects: sex, year-season of birth, littersize, age of dam
  - Random effects: animal, permanent litter environment, residual

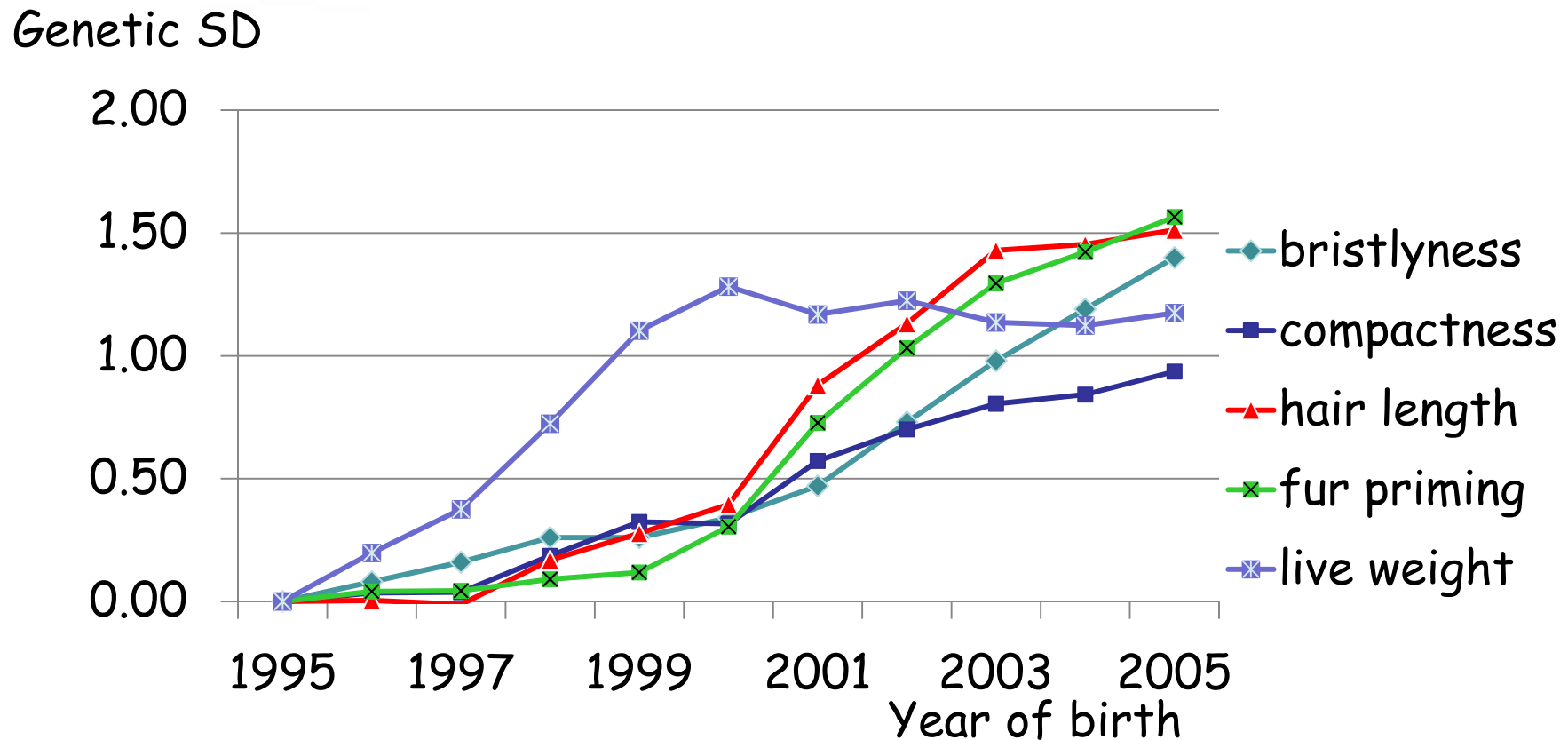→   Genetic trends and genetic parameters

Direct response to selection with control group (cryopreserved embryos)

Trait	Overall mean	Raw phenotypic gain	Contrast SG – CG (se)	test
Bristlyness (score)	36.29	27.5%	- 11,34 (2.99)	***
Fur priming (score)	4.40	41.5%	- 2.55 (0.93)	**
Fur length (mm)	19.58	6.6%	+ 0.84 (0.38)	*
Compactness (0,01mm)	38.72	4.4%	+ 1,97 (3.20)	ns
Live body weight 16w (g)	2305	20,0%	+ 150 (53)	**

Large phenotypic gain on bristlyness and fur priming

Direct response to selection
Genetic trends 1995 - 2005

Large genetic gain on bristlyness, hair length and fur priming

Genetic parameters

	Bristlyness	Hair length	Compactness	Fur priming	Live weight
Bristlyness	**0.24**	0.25	0.00	-0.15	0.10
Hair length	*0.07*	**0.30**	0.32	- 0.36	0.15
Compactness	*-0.01*	*0.10*	**0.22**	0,19	-0.15
Fur priming	*0.03*	*- 0.25*	*0.04*	**0,29**	-0.05
Live weight	*-0.02*	*0.09*	*0.00*	*-0.08*	**0.45**

heritabilities, genetic correlations,
phenotypic correlations

Estimates similar
to previous studies

Genetic trends 1995 - 2013

Genetic SD — Year of birth

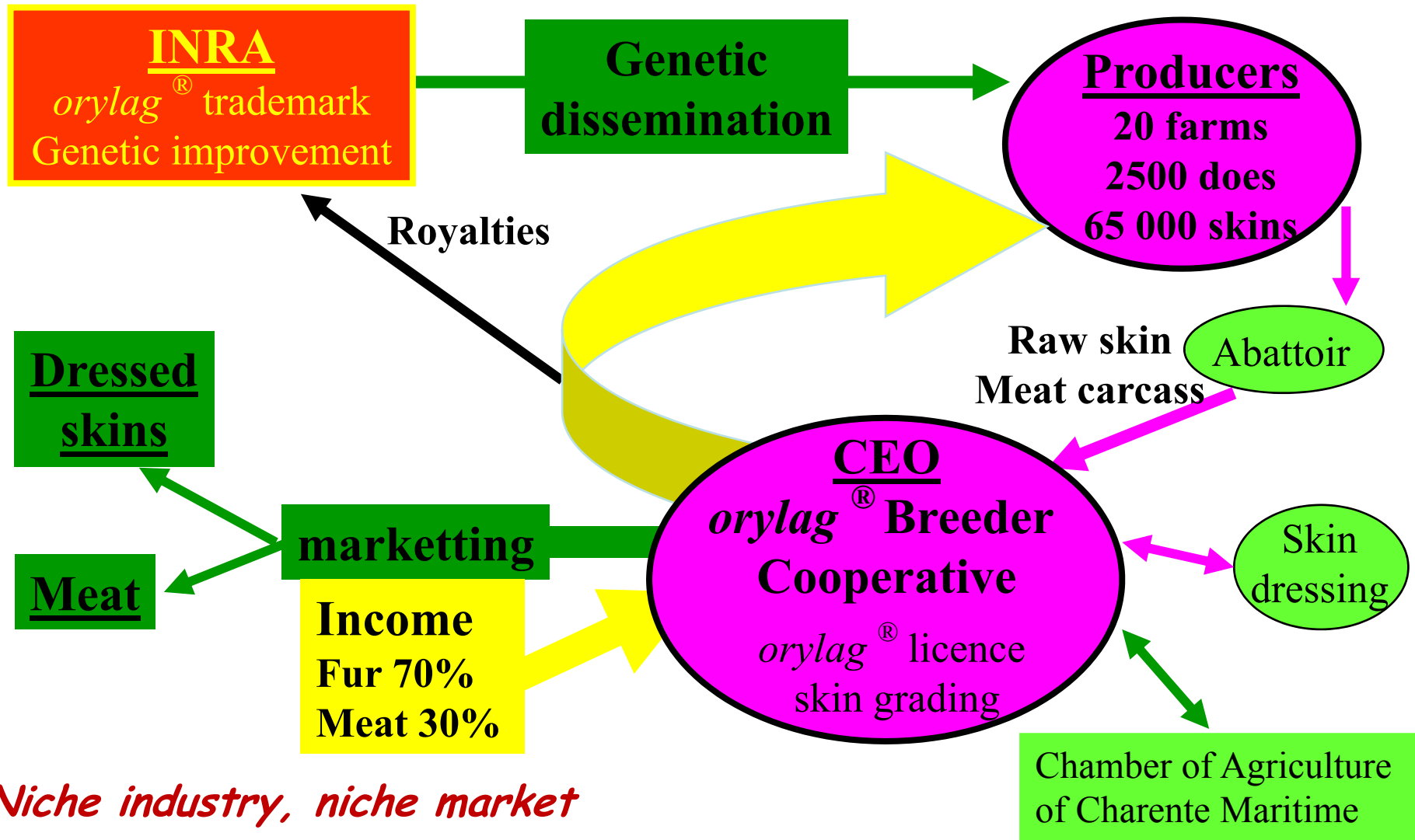bristlyness, compactness, hair length, fur priming, live weight
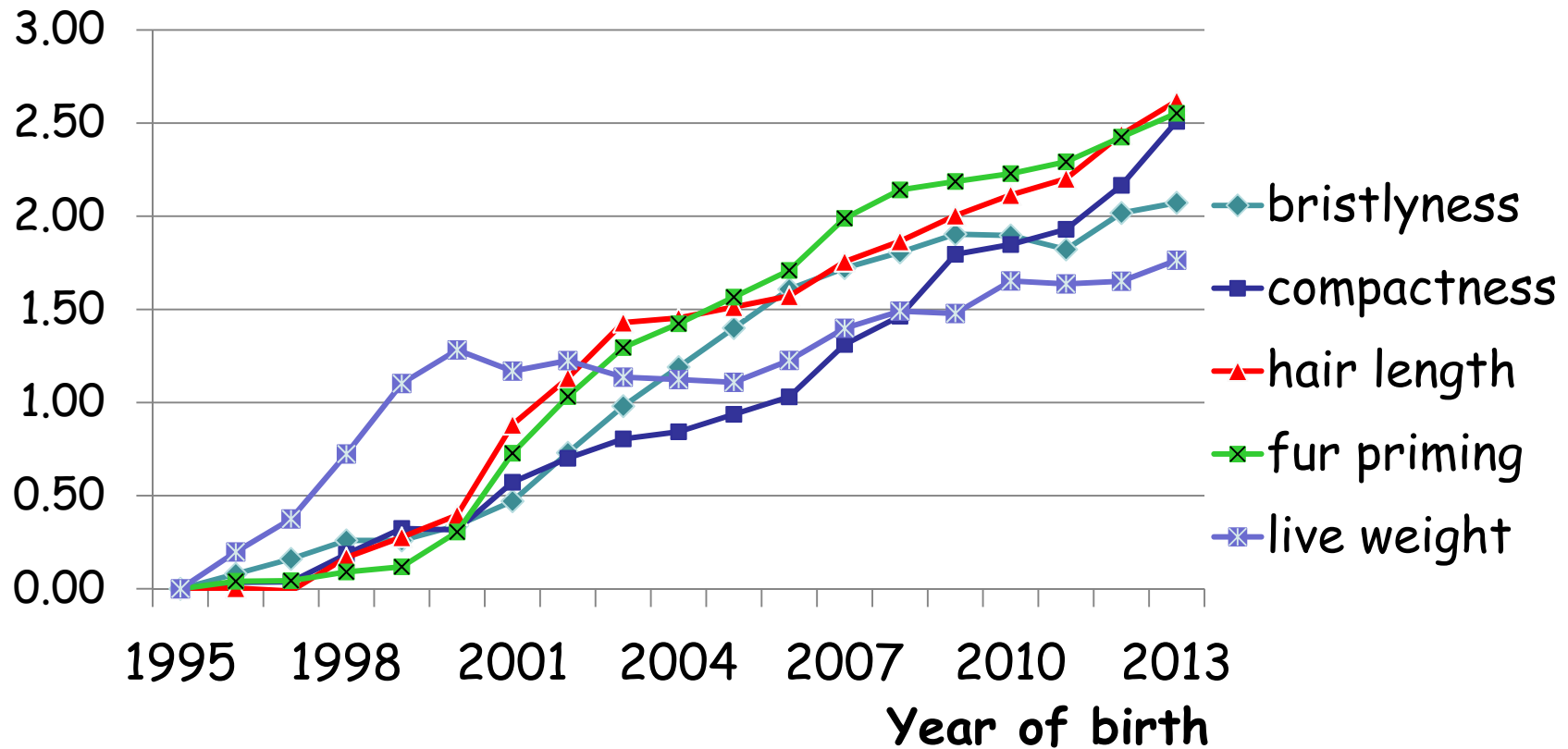
Conclusions
Response to selection for $orylag$ ® traits
by using cryopreserved control population

- No genetic diversity loss in control population

  – despite low reproductive results after embryo transfer

- By comparing selected and control populations

  – High Direct response to selection for orylag fur traits

    - Large phenotypic and genetic gains on bristlyness and fur priming
    - $1 – 1.5\ \sigma_g$ in 10 years from 1995
    - $2 – 2.5\ \sigma_g$ up to now from 1995

  – Favourable response on live weight

Cryopreserved control population : efficient tool
→ response to selection on $orylag$ ® fur traits

INRA
SCIENCE & IMPACT

orylag ® industry organisation

INRA
orylag ® trademark
Genetic improvement

→ **Genetic dissemination** →

Producers
20 farms
2500 does
65 000 skins

Royalties

Raw skin
Meat carcass

Abattoir

Dressed skins

Meat

marketting

Income
Fur 70%
Meat 30%

CEO
orylag ® Breeder Cooperative
orylag ® licence
skin grading

Skin dressing

Chamber of Agriculture of Charente Maritime

Niche industry, niche market

Conclusions

- *orylag* [R] fur is now absolutely different from Rex fur:
  - ✓ 25 years selection
  - Very soft fur: natural dehaired
  - Very light : early fur priming & exclusive dressing process
  - Natural short hair
  - Near similar to chinchilla fur
  - Large use by furriers. designers. haute couture
    - well adapted to consumer and designer demand
  - Original development programme
    - INRA,
    - producers, breeder organisation, marketing

Source: CEO

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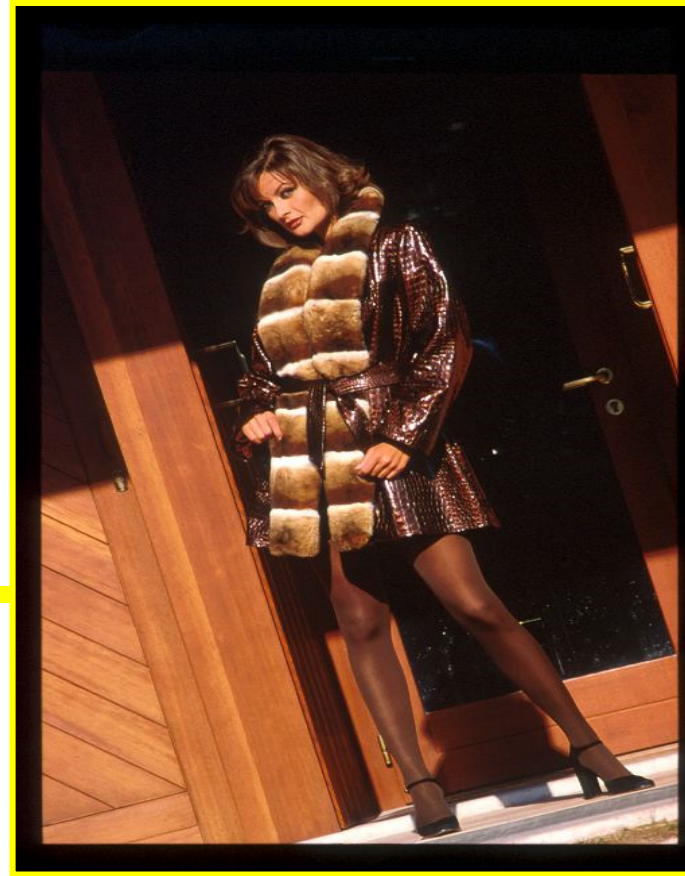
Source: CEO

Thank you for your attention

Source: CEO

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