International issues in dairy cattle genetics

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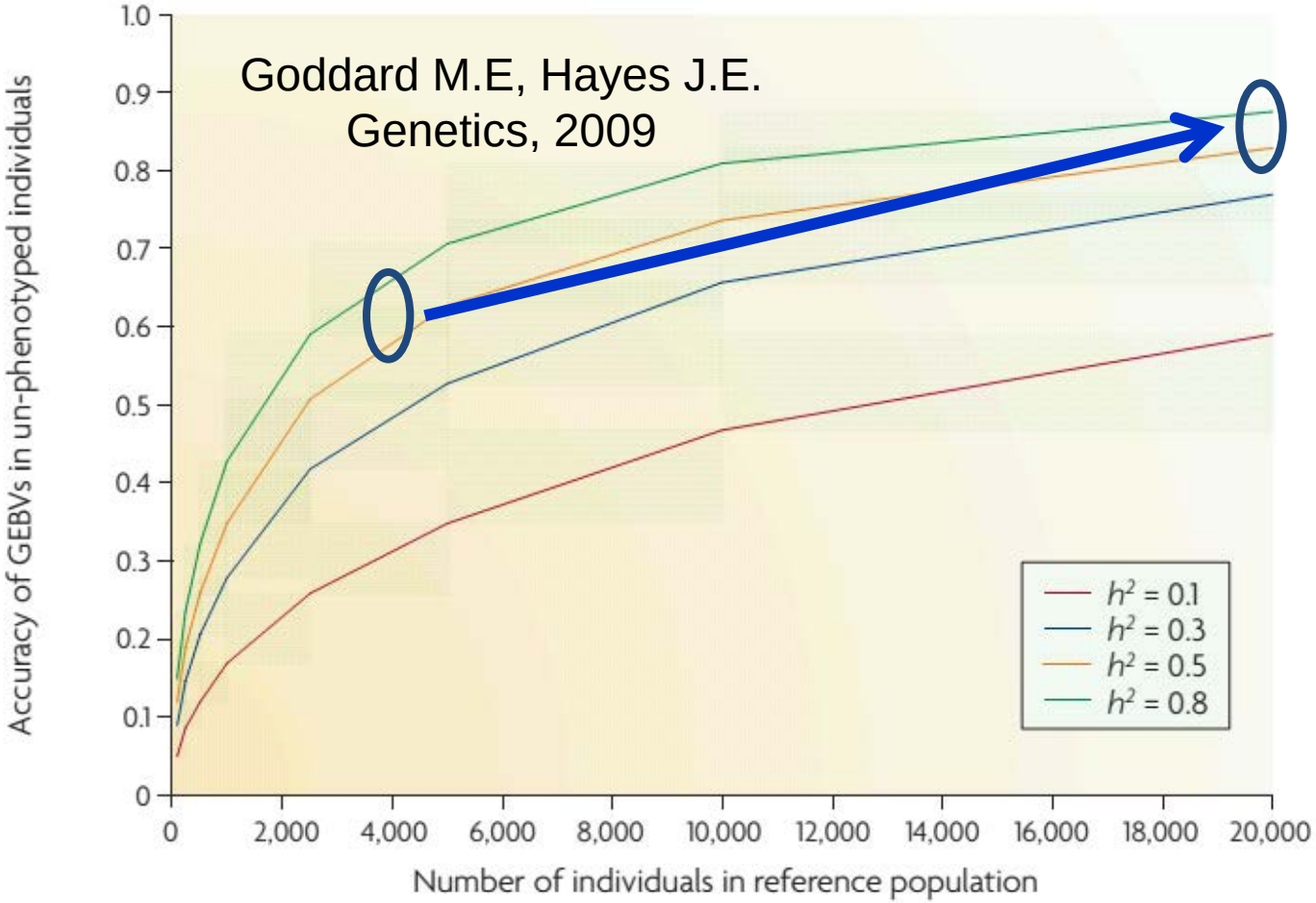
Outline

- New context: **genomic era**
- Principles of **international genetic evaluations** / **Interbull**
- How do farmers get access to the best bulls with genetic or genomic evaluations
  - *from countries which are Interbull members*
  - *from the others* (with/without genetic or genomic evaluations)
- Key messages

Genomic selection: very fast adoption

- Started between 2008 and 2010
- **Reference population** = genotyped progeny-tested bulls from which estimates of the effect of tiny chromosome segments are computed
- Reference population size = key parameter of accuracy of genomic selection

Importance of reference population size



Genomic selection: very fast adoption

- Tens of thousands of young calves genotyped each year
- Organized progeny testing: decreased or abandoned
- **Market share of semen from young bulls: 40 to 75%**

International Genetic Evaluations

- National evaluations are not directly comparable
  (different traits, different production system and environments, different recording systems, different models of analysis)

- For the past 30 years, Interbull has made such comparisons possible (+ has contributed to the international recognition of national evaluations (harmonization, validation))

Interbull

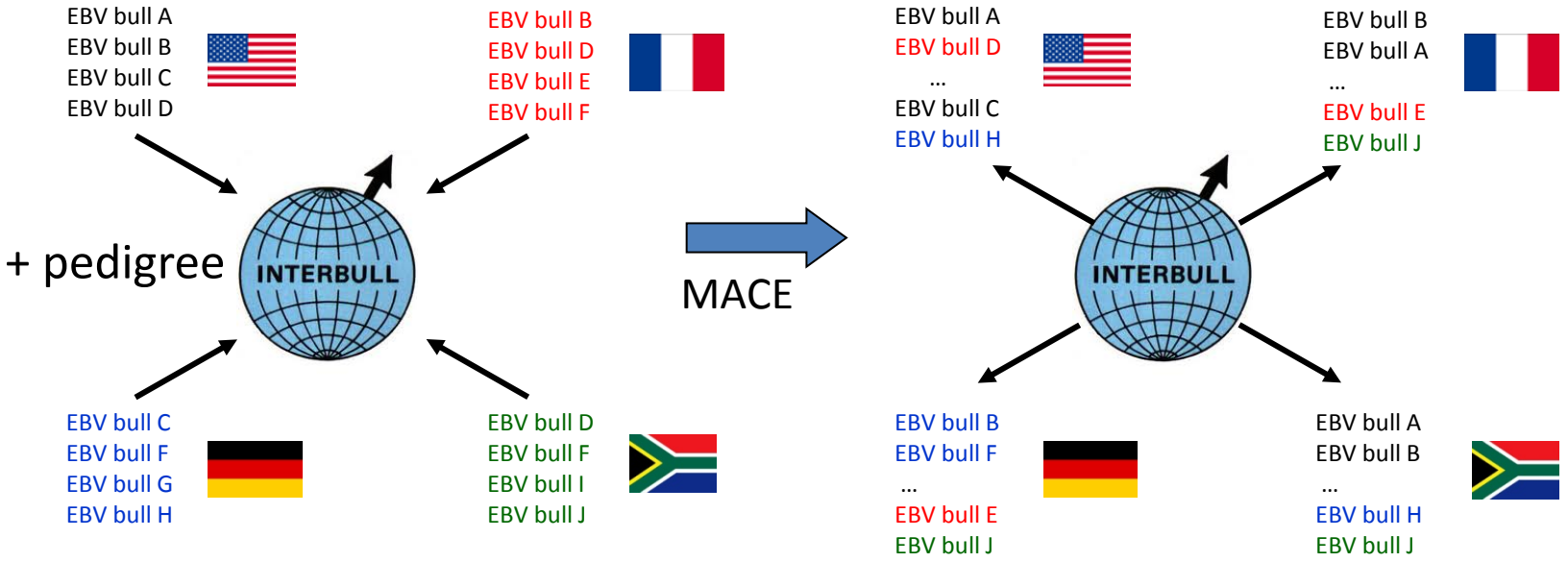
- 32 member countries

- 6 (groups of) breeds: Holstein, Simmental (including Montbéliarde) Brown Swiss, “Red” Dairy cattle, Jersey, Guernsey.
- Traits: Production, Type, Udder Health, Fertility, Longevity, Workability, Calving traits

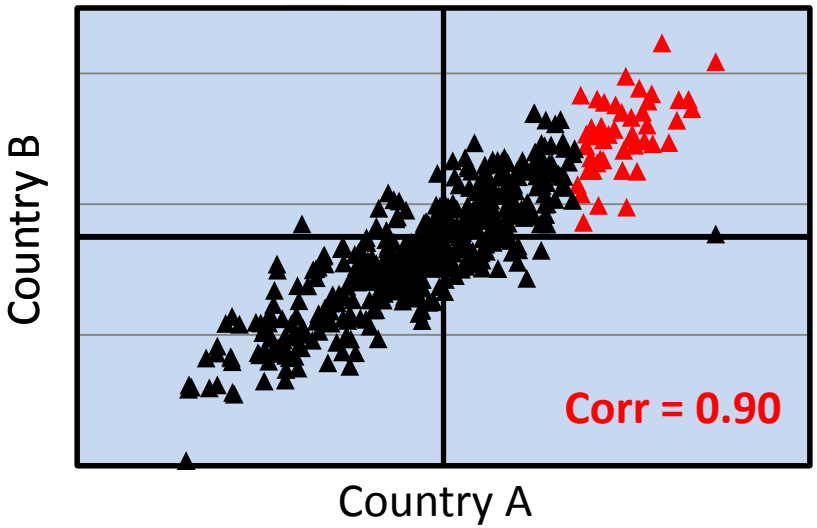
International genetic evaluations

- Meta-analyses of national results of <u>bulls</u>

MACE = Multiple Across Country Evaluation



How much reranking ?



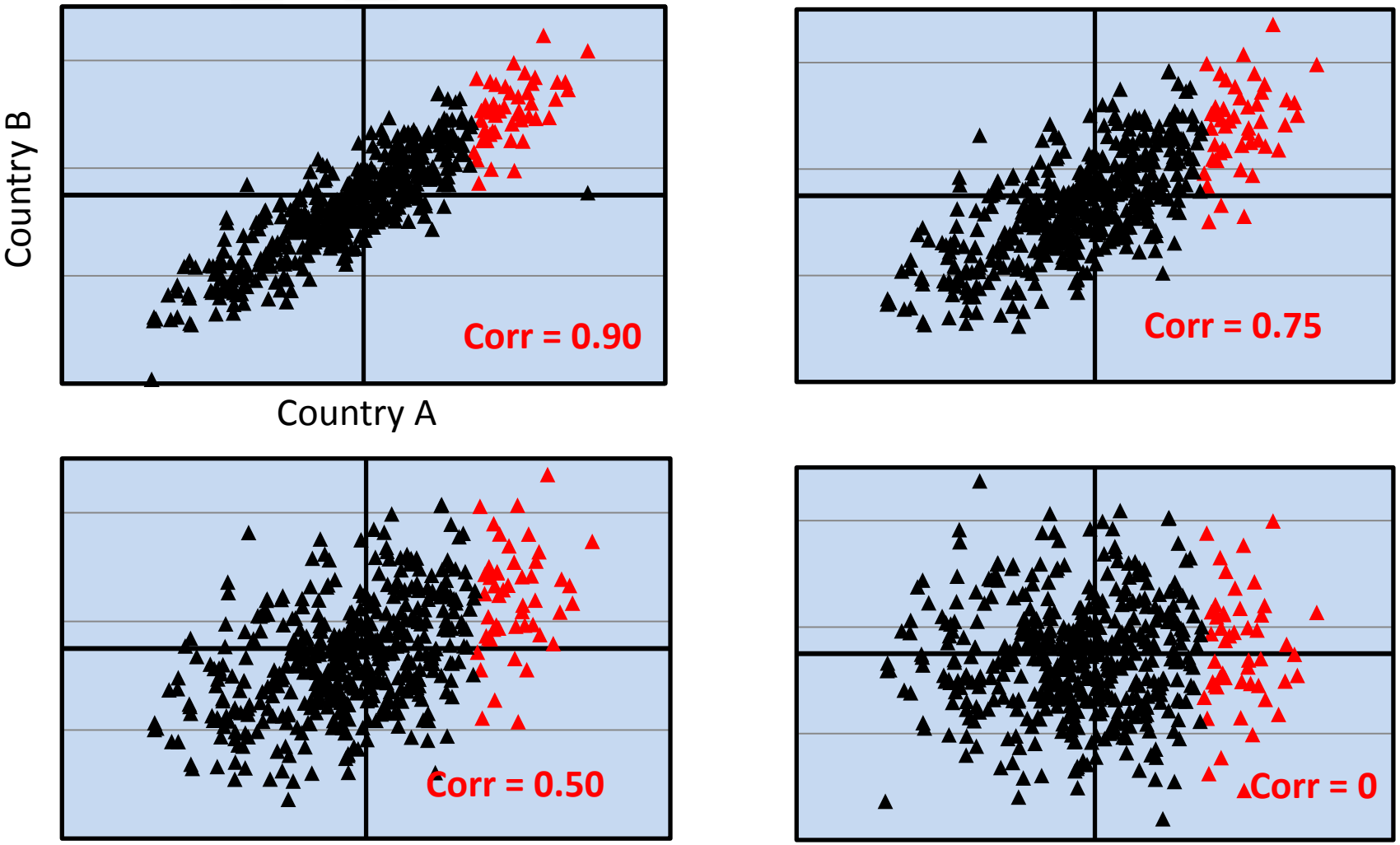
Depends on **genetic correlation between countries**

(= a measure of Genotype x Environment interaction)

Within Europe or North America

(for production traits)

How much reranking ?

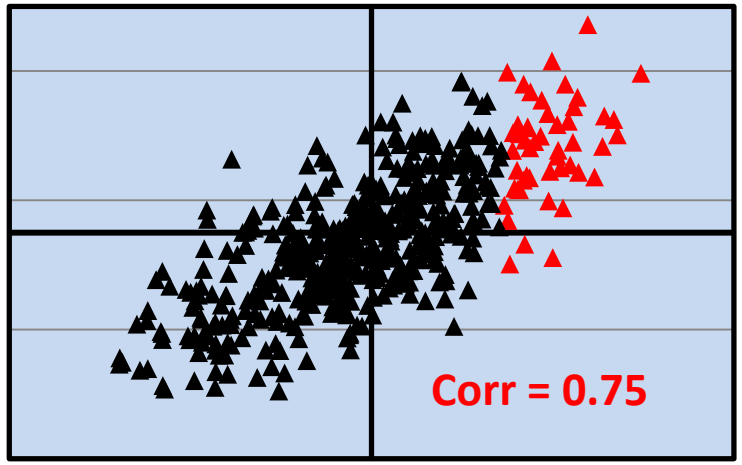


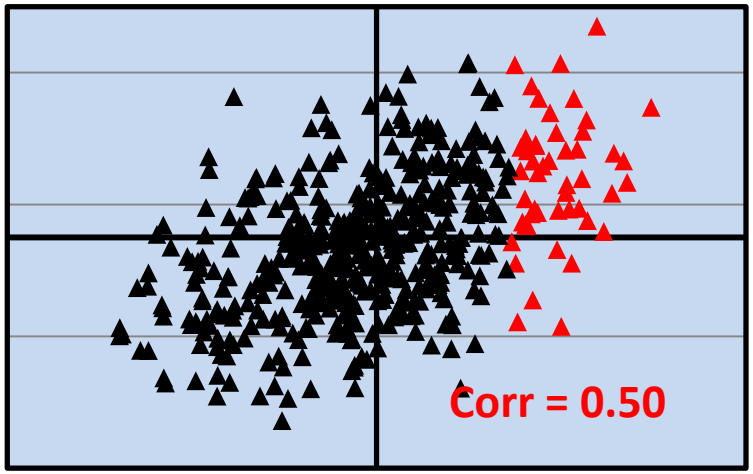
How much reranking ?

Between New Zealand or

Ireland and continental Europe

(or some fertility traits)





Between Kenya and UK

(Ojango et al, 2003)

Farmers /breeding organisations: Consequences

- **Strongly depends on the country situation**
  - ✓ Is it an Interbull member? (access to international ranking on **own national scale**)
- **Even more complex with genomic evaluations**
  - ✓ Access to a (inter)national reference population ?

Interbull members

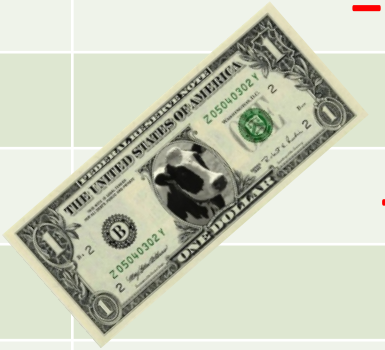
Non members

- ✓ Europe? too many scales !!!

  which one to choose ?

US scale

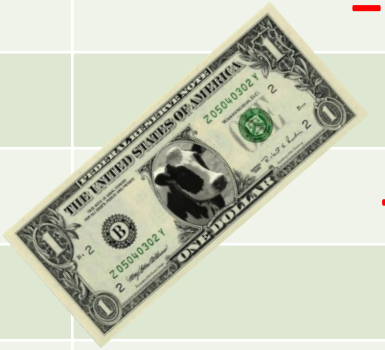
	Net merit (NM$) (2010)	
(Milk)+Fat+Protein	35	
Longevity (PL)	22	48
Somatic cells	–10	
Fertility (DPR)	11	
Calving diff./ Stillbirth	-5	
Type composite		
Udder composite	7	17
Feet/legs composite	4	
Body size	–6	



Source 1: Net merit as a measure of lifetime profit: 2010 revision *J. B. Cole et al.,* AIPL, ARS-USDA

US scaleS

	Net merit (NM$) (2010)		TPI (2011)	
(Milk)+Fat+Protein	35		43	
Longevity (PL)	22	48	10	29
Somatic cells	–10		-5	
Fertility (DPR)	11		11	
Calving diff./ Stillbirth	-5		-3	
Type composite			10	28
Udder composite	7	17	12	
Feet/legs composite	4		6	
Body size	–6			



Source 1: Net merit as a measure of lifetime profit: 2010 revision *J. B. Cole et al.,* AIPL, ARS-USDA

Source 2: http://www.holsteinusa.com/genetic_evaluations/ss_tpi_formula.html

TPI: the worst possible choice for many countries

- Very strong emphasis on type: the big “show” cow
- Not adapted to suboptimal environments !






- Most American farmers don’t use it !

Alternatives do exist !

- Use Net Merit $!
- Use Interbull results on a more adequate Interbull scale

  (New-Zealand, Ireland, South Africa, Argentina …)
- For low input environments: choose a more sustainable Total Merit Index combining Interbull information

  30% Fertility, 30% Health, 20% Longevity, 10% Production, 10% Feet and legs ?

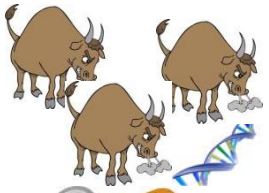
  ➔ A much larger choice of (cheaper) bulls

  ➔ genetic level may still be (too) high for production

  ➔ for exporting countries: larger range of bulls

Genomic era: Interbull members

Reference population



Interbull members : the ideal situation

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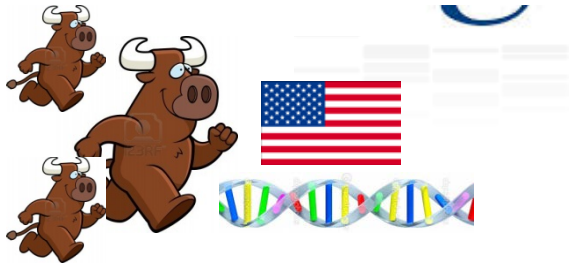
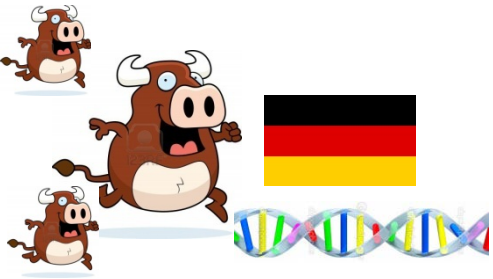
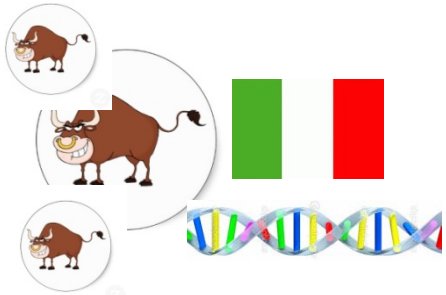
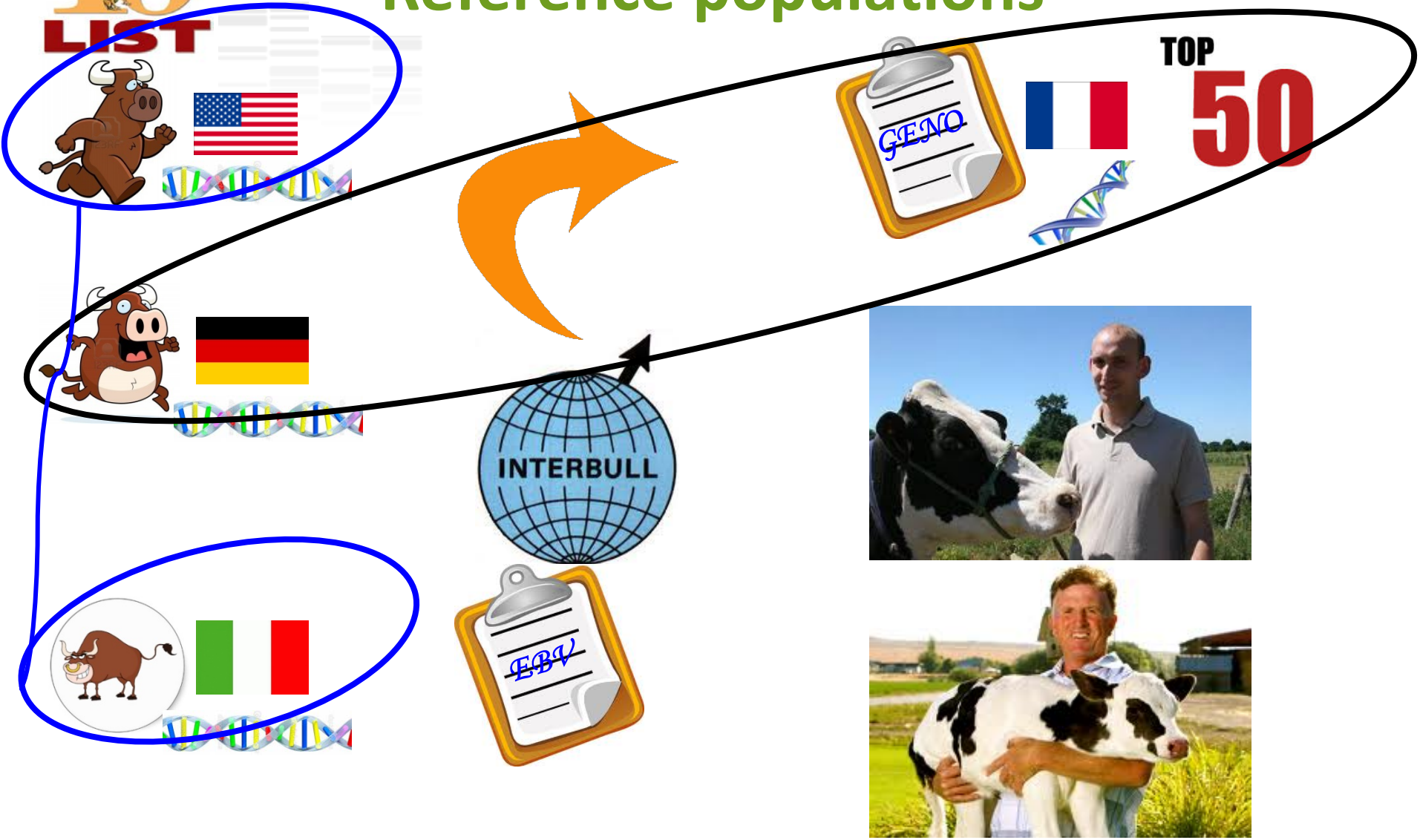




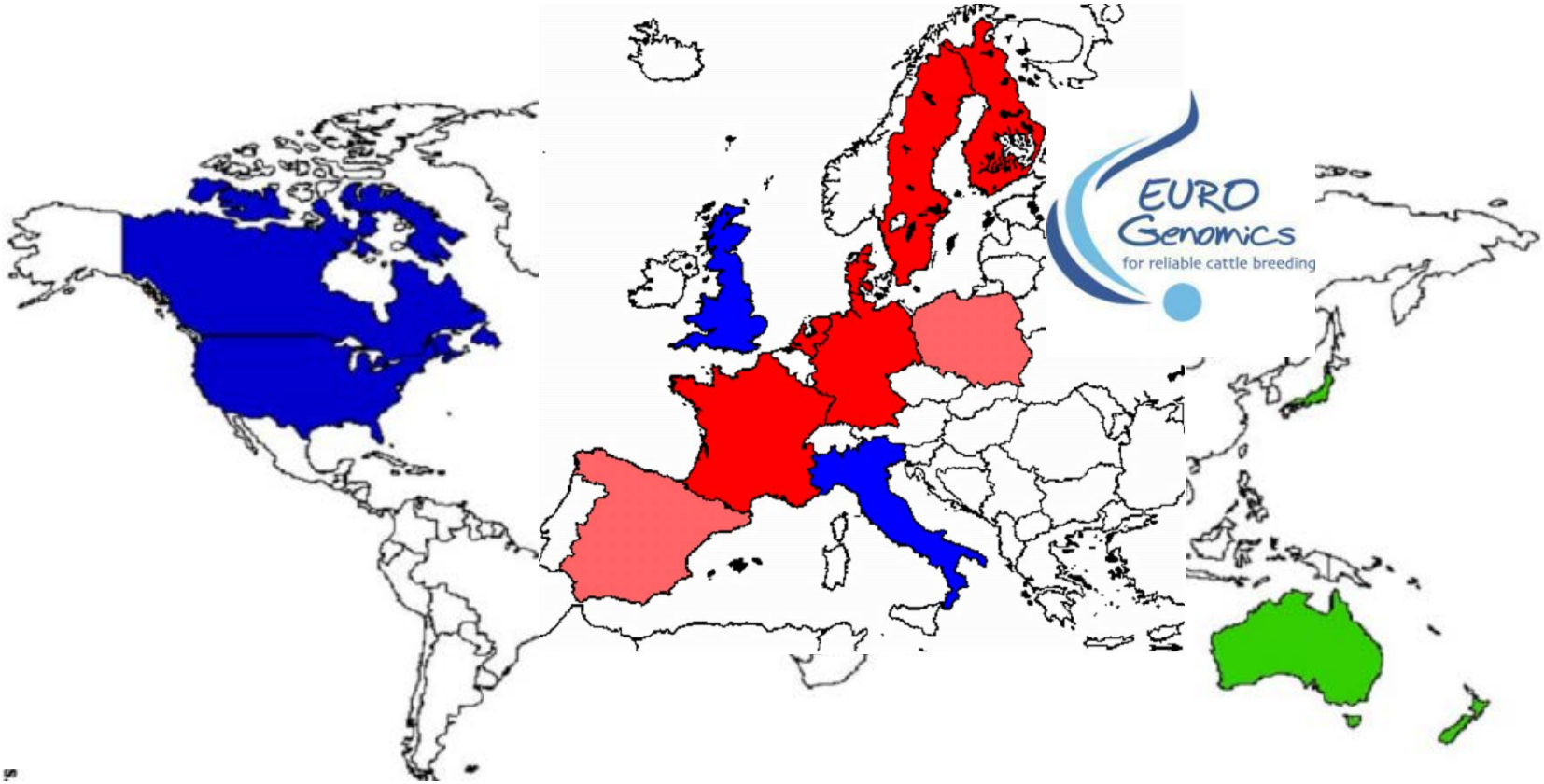


Reference populations



The Holstein situation

- favors the largest (groups of) countries able to jointly assemble large reference populations ➔ 2 large consortia



Issues for countries with genomic evaluations

- Each country has its own genomic evaluation with its own particularities and its own scale
- Interbull ***does not*** have access to (Holstein) genotypes

✓How to insure fair across country GEBV comparison?

✓Interbull is developing a GMACE (extension of MACE) but faces technical + political problems

Issues for countries with genomic evaluations

- Interbull ***genetic*** evaluations are extremely important
  - ✓ **Only way** to combine reference populations from different countries !
  - ✓ BUT resulting ***genomic*** evaluations are **better** (G x E free) !

… for countries **without** genomic evaluations

- How to benefit from genomic information ?
  - ✓ How to create a national reference population large enough?
  - ✓ How to join a consortium (and which one?)
  - ✓ How to compare foreign GEBV from different countries ?
    - ✓ Rely on GMACE ? Just starting (trust?)
    - ✓ Not comparable scales ➔ Currently the most popular is **GTPI** !

e.g., on tweeter:

A longer term, more sustainable alternative

- Help (sufficiently large) countries with performance recordings
  - ✓ **to join Interbull**
  - ✓ and **to benefit from existing reference populations**

  … in order to develop genomic evaluations adapted to the local conditions and to import the best young bulls worldwide for the local needs

- e.g., INRA program GENOSOUTH with South Africa, Brazil and India

Key messages

- Genomic selection is characterized
  both by intense international **collaboration**
  and strong economic **competition**,
  in particular in Holstein
- Even for large exporting countries, collaborations are still needed
  - use of sequence data: 1000 genome projects
  - phenotyping of new traits (feed efficiency, methane emission)
- The gap between leading countries and the others is widening fast,
  to such an extent that **« collaborative spirit » is declining**

Key messages

- Fair across-country comparisons are (and will remain) a necessity
- **Interbull plays (and will play) a central role**
- For importing countries without own genetic/genomic evaluation: **a proper choice of scale is essential** and the (G)TPI is certainly NOT the most sustainable one
- For (large) importing countries, **becoming an Interbull member and developing an own genomic evaluation is strategic**
- A unique (€) scale for genetic evaluations would make Europe stronger on the international market

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LABOGENA

Thank you

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