

Genebanks in the genomics era

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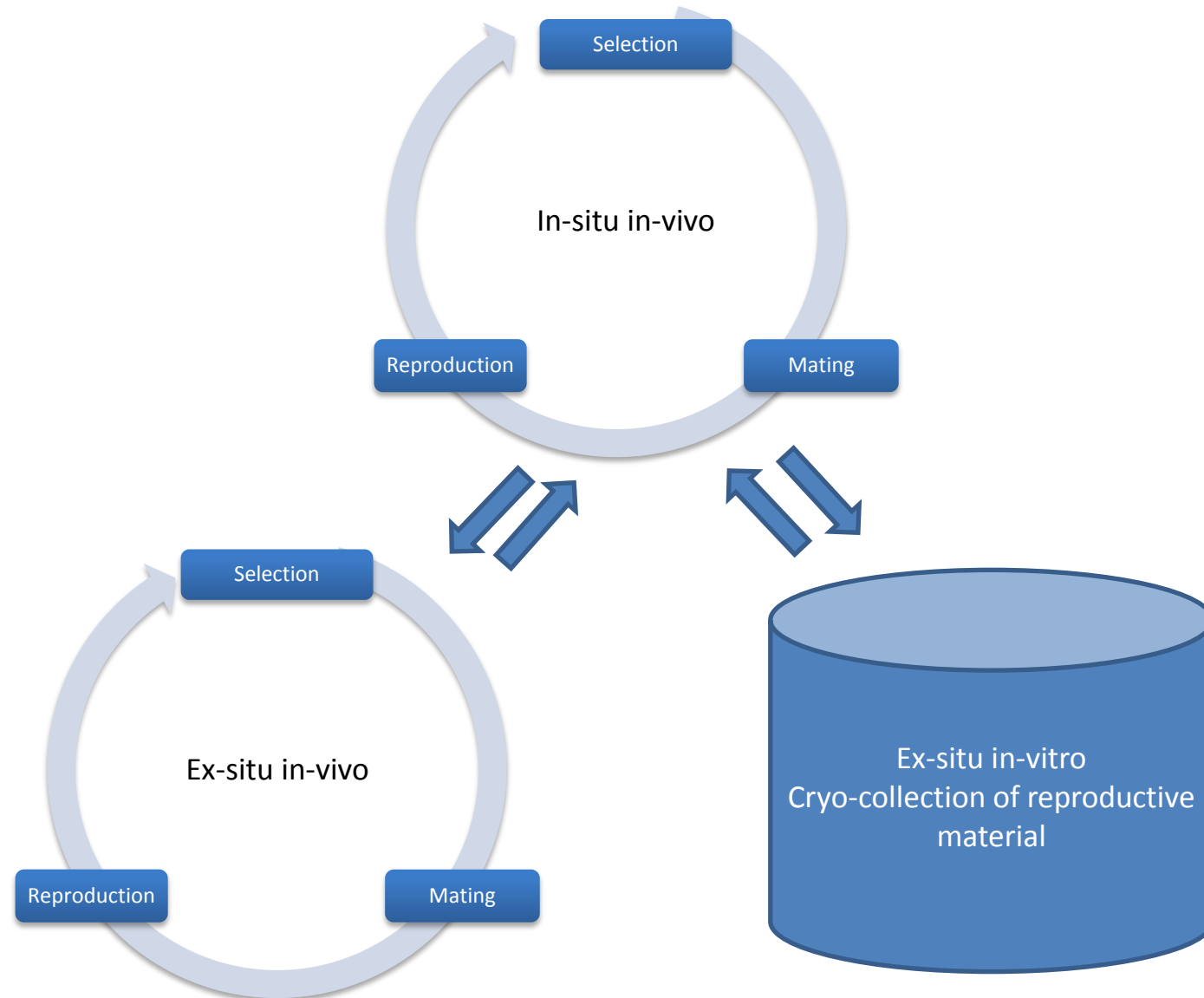
What is a genebank?

- ❑ Cryo-conserved reproductive material
 - ❑ Long-term storage
 - ❑ Semen and embryos
 - ❑ Technology
 - ❑ Species
- ❑ Reduced viability after cryo-conservation

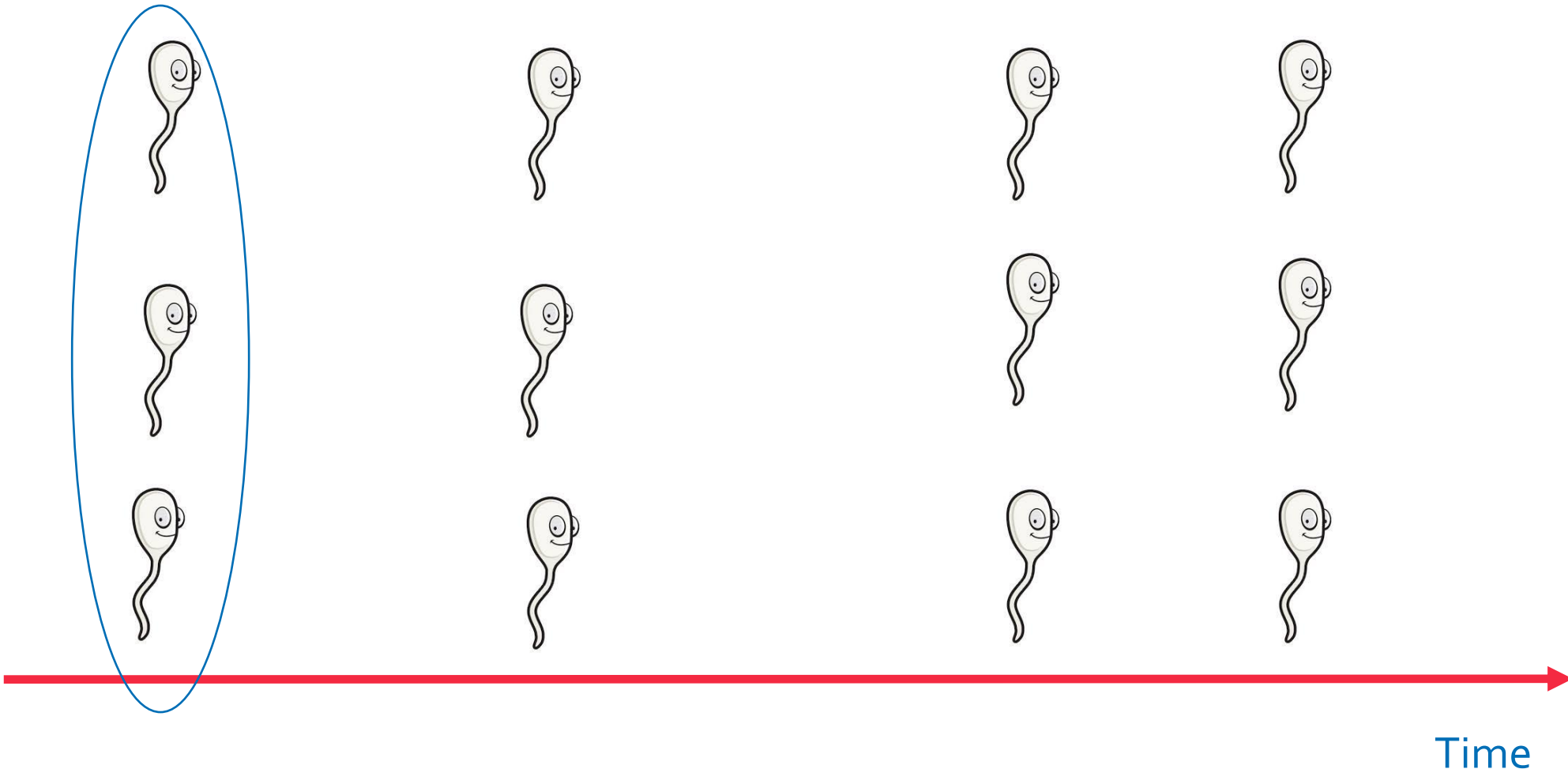


Role of genebanks

- Long-term storage
- Back-up
- Supplementary to in-situ
- Population management
- Document genetic progress
- Research



Role of genebanks



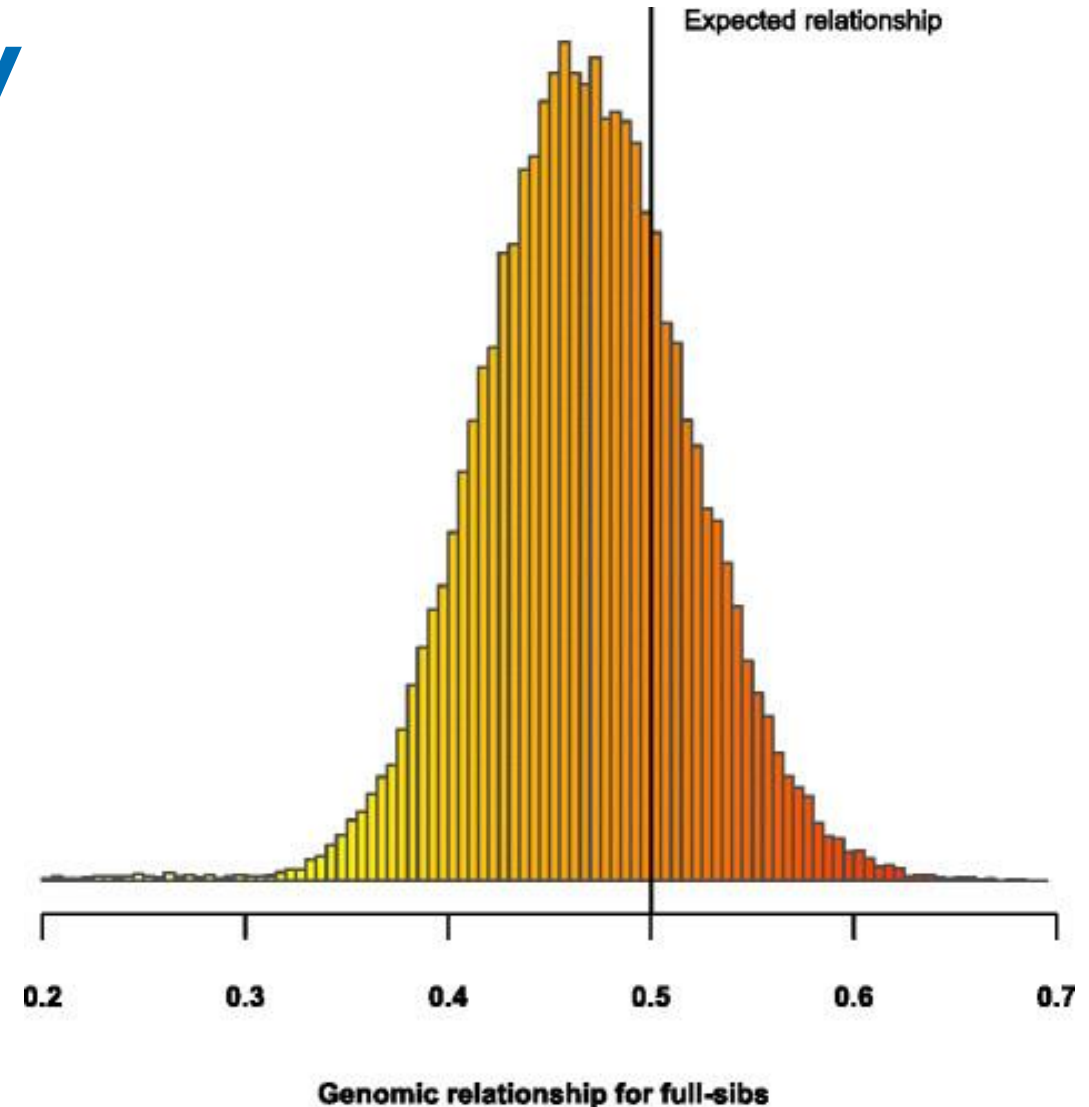
Added value of genomic information

- Inventory
- Maintaining specific alleles/haplotypes
- Sampling animals for cryo-conservation
- Use of genebank samples
- Research
- More efficient introgression



More detailed inventory

- Genomic vs. pedigree relationships
 - Within breeds
 - Between breeds
- Specific alleles or haplotypes
 - E.g. Halothane sensitivity allele
 - E.g. PrnP haplotypes

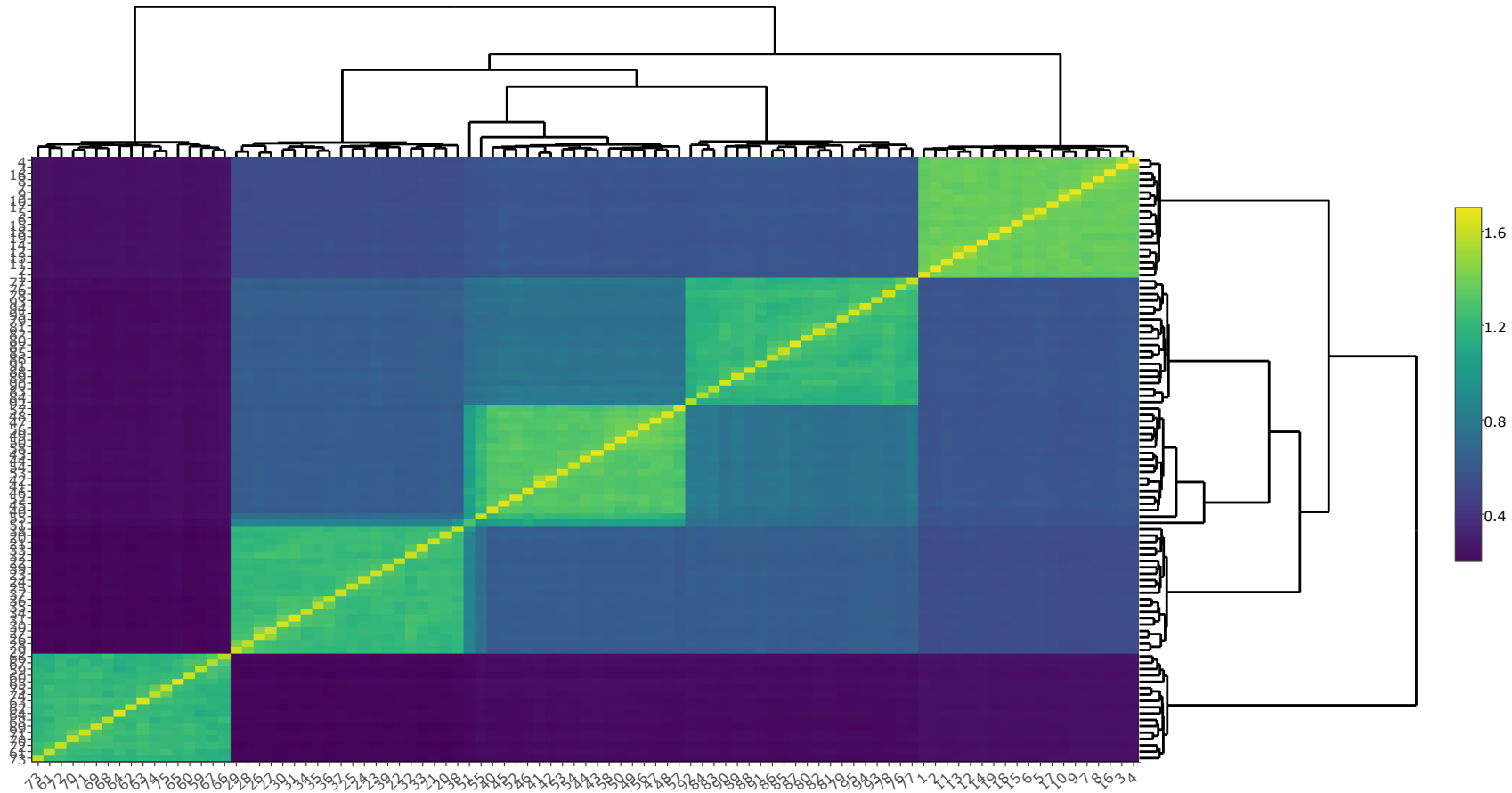


Lourenco et al. 2015

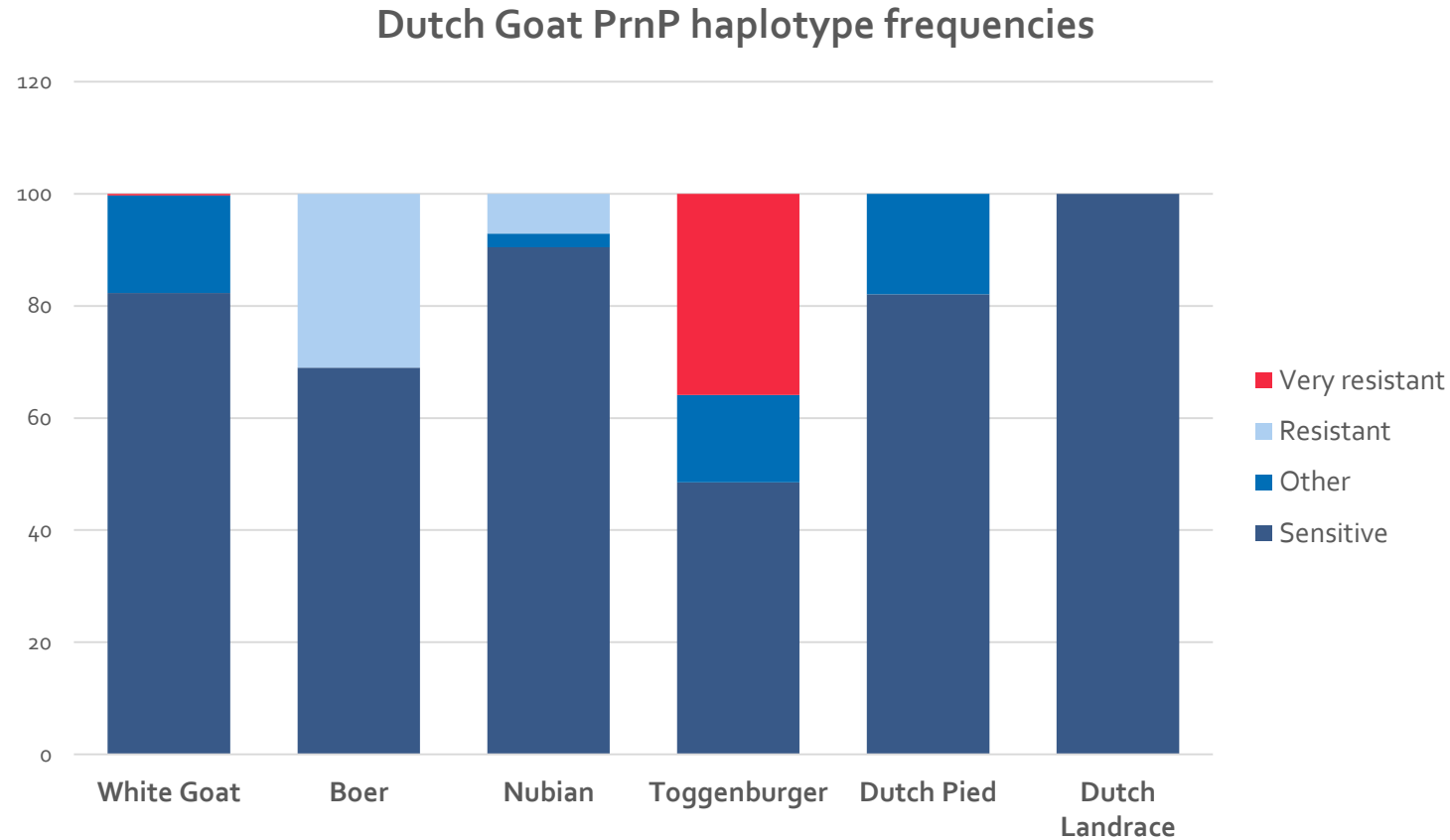


Genomic relationships

5 Norwegian poultry breed



PrnP haplotypes in Dutch goats



Modified from Windig et al. 2016

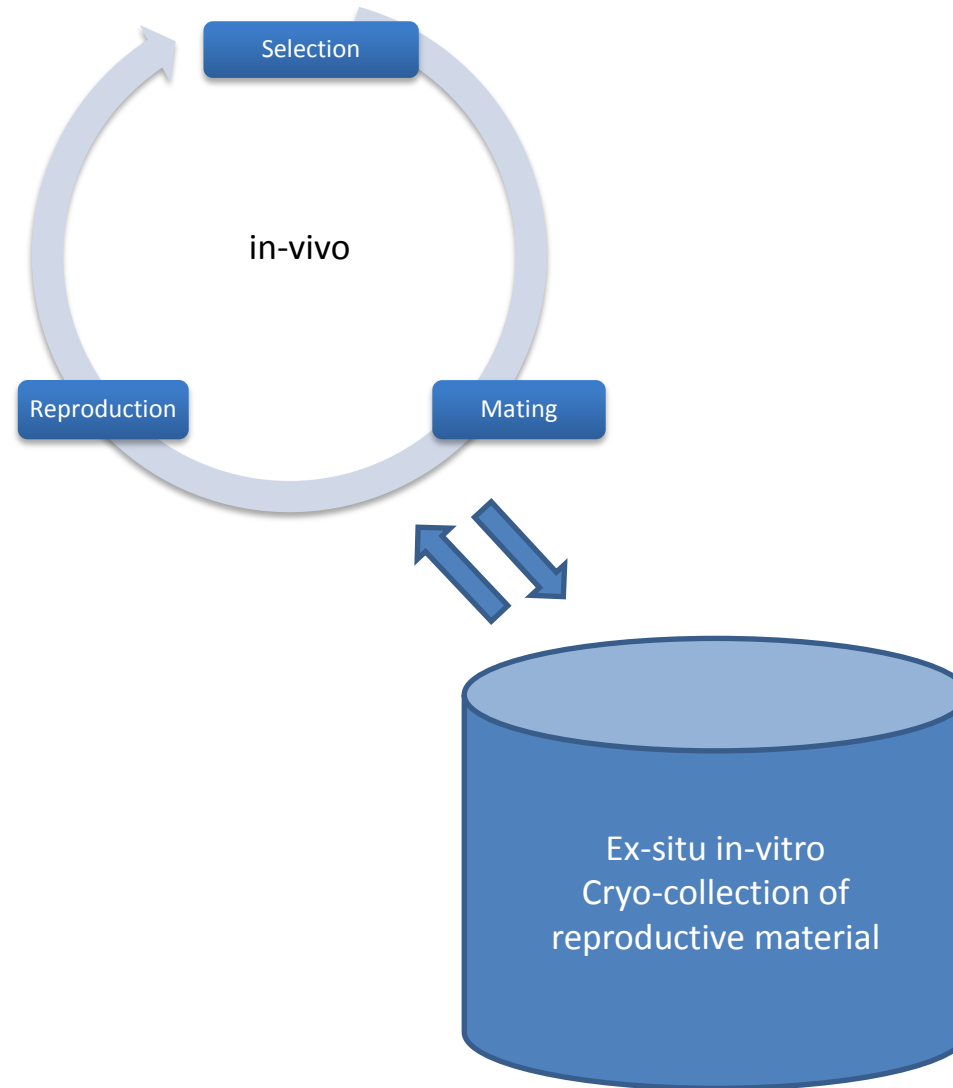


Selecting animals for cryo-conservation

- Maximise diversity in cryo-collection
- Minimise relationships between donors

$$\bar{r} = c' Hc$$

- Subject to constraints
 - Non-negative contributions
 - Maximum contributions
 - Sum of contributions



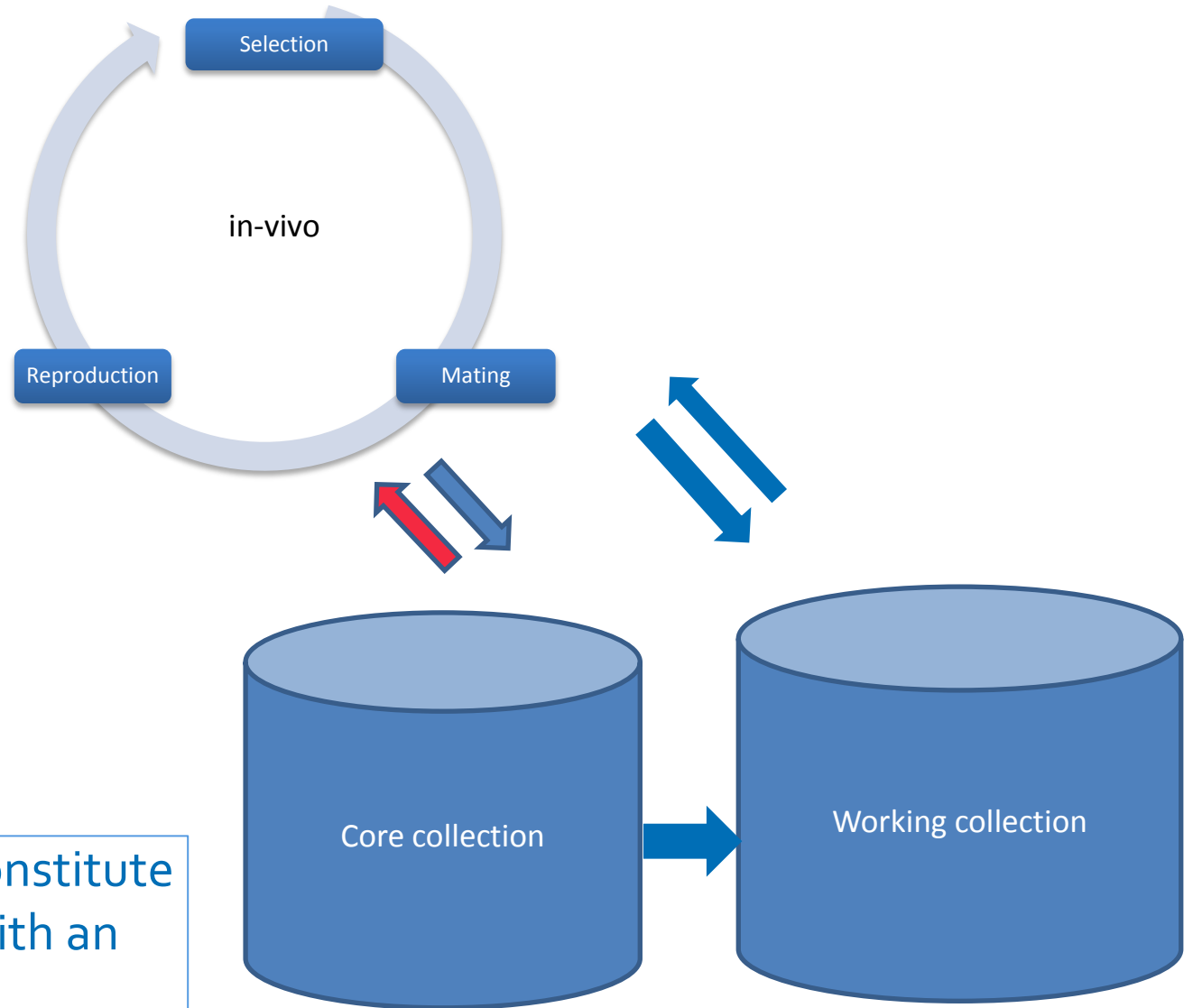
Using samples from cryo-collections

- Maximise diversity in cryo-collection
- Minimise relationships between donors

$$\bar{r} = c' Hc$$

- Subject to constraints
 - Non-negative contributions
 - Maximum contributions
 - Sum of contributions

Collection to reconstitute
a population with an
Ne of 50



International conservation value

Norwegian poultry breeds

Set	Genetic Diversity	% lost	Priority
Synbreed + NO breeds	0.5299	-	
Jærhøns lost	0.5287	0.22	4
Rokohøns lost	0.5287	0.23	3
NorBrid 1 lost	0.5249	0.94	2
NorBrid 4 lost	0.5290	0.17	5
Norbrid 8 lost	0.5149	2.84	1



Research

- ❑ Genomic selection
- ❑ Deleterious alleles with pleiotropic effects
 - ❑ E.g. Halothane sensitive alleles
- ❑ Historical information
 - ❑ Effects of selection
 - ❑ Extreme genotypes
 - ❑ Links to phenotypic information



Documentation

Link cryo-conserved samples to

- Phenotypic records (EBV)
- Genomic data
- Socio-cultural descriptors



Acknowledgement

Jack Windig

Kor Oldenbroek



Gene-editing

- ❑ “Correct” deleterious alleles
 - ❑ Several candidate loci
- ❑ Introduce variation at specific loci
 - ❑ Few candidate loci
- ❑ Identification of candidates
 - ❑ Historical diversity
 - ❑ Comparative diversity across breeds and species

