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Biotechnology and
Biological Sciences
Research Council

Supporting the Implementation of Genomic Selection in a Guide Dogs' Population using Simulation

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Implementing genomic selection

From genetic selection, [...]

- Breeding program

- Phenotypes and pedigree information
- Long-term breeding goals

[...] into genomic selection

- Genomic information

- Which genotyping technologies?
- Which individuals?

What is the best strategy to collect genomic information?

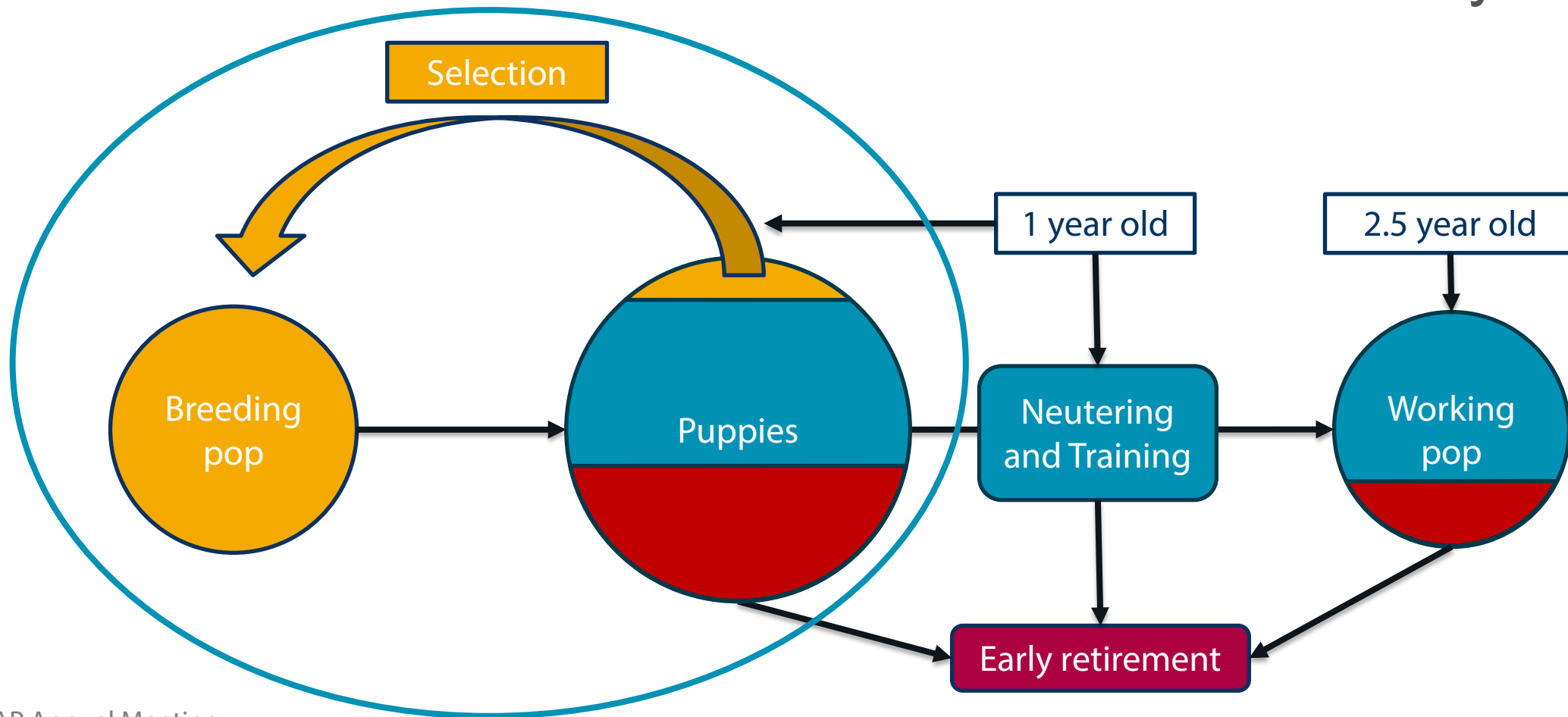


Test with simulation!

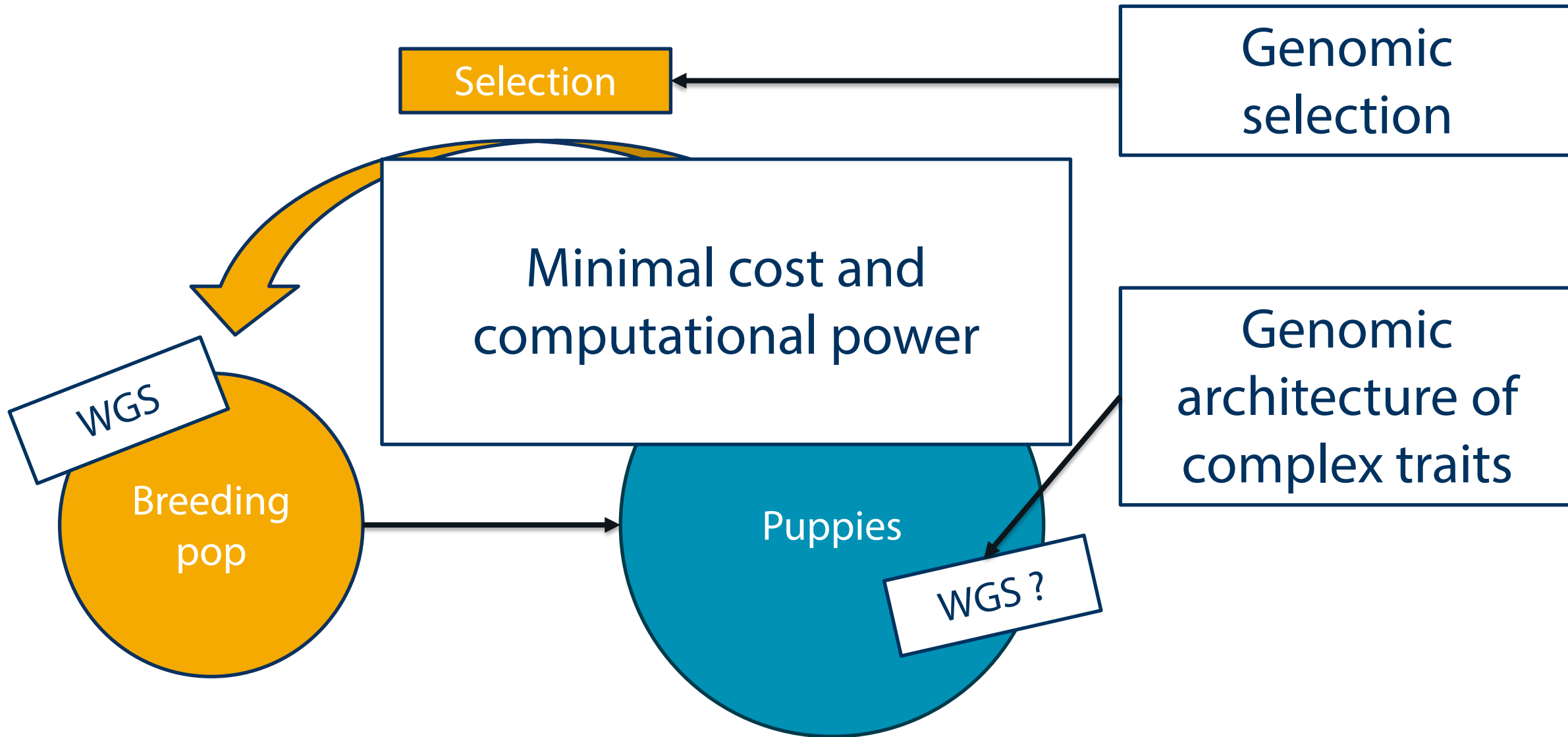
Born to Guide



Breeding program to improve health,
welfare and trainability



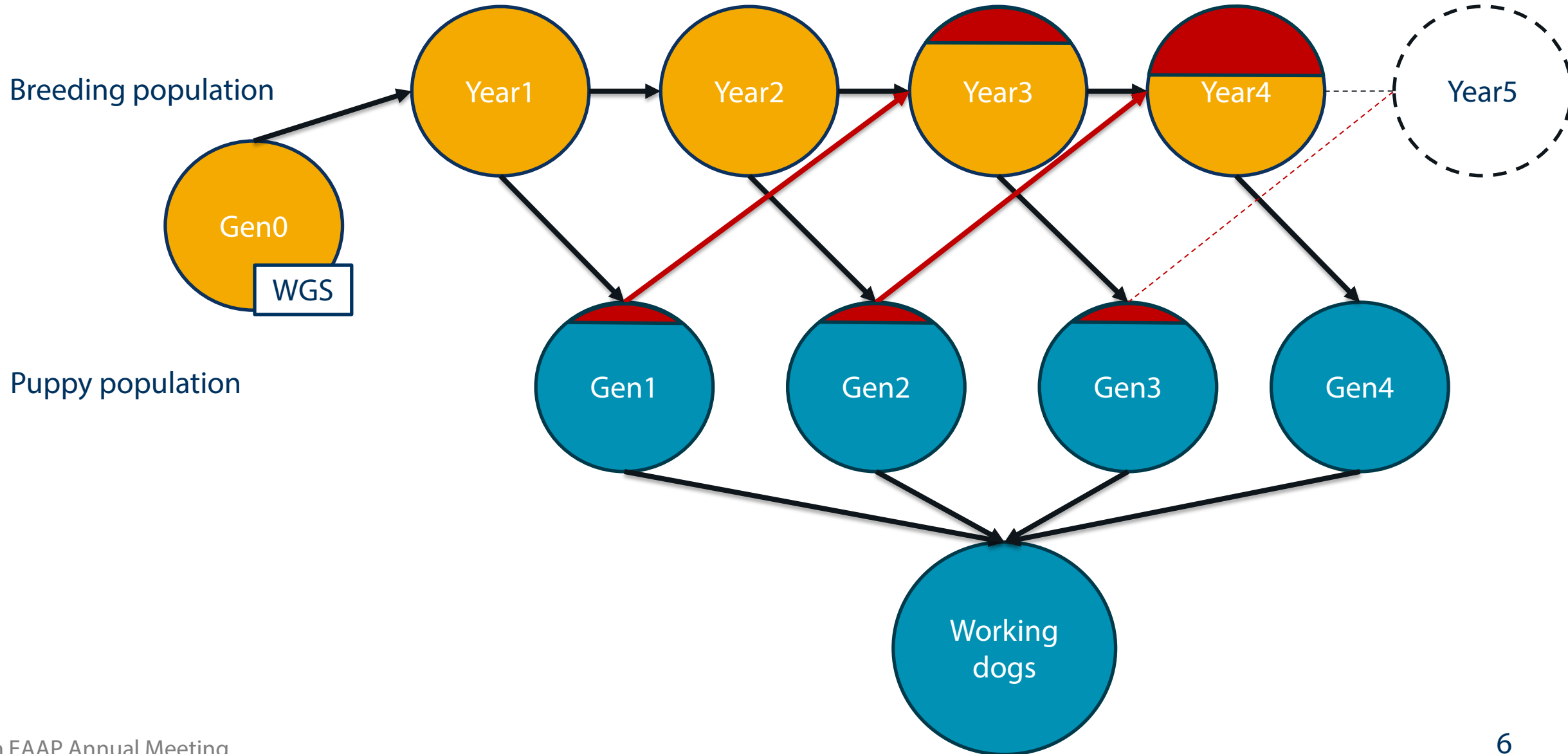
Guide Dogs objectives



Simulation process

1. Recreate the population using **AlphaSimR**
2. Generate x puppies per year (5 generations)

Simulated GD population structure



Simulation process

1. Recreate the population using AlphaSimR
2. Generate x puppies per year (5 generations)
3. **Generate the sequence/genotype data based on the scenarios**

Scenarios for the genomic information

- Current breeding dogs (Gen0) have high-coverage sequencing data
- Puppies can have different types of genomic information:
 - SNP genotyping (710K, 170K, 50K, 25K)
 - Low-pass sequencing (2X, 1X, 0.5X)

Simulation process

1. Recreate the population using AlphaSimR
2. Generate x puppies per year (5 generations)
3. Generate the sequence/genotype data based on the scenarios
- 4. Impute to WGS using Alphapeel (multi-locus peeling)**
- 5. Evaluate the individual imputation accuracy**

SNP genotyping

Low-pass sequencing

Scenario comparison

	Low-pass sequencing	SNP genotyping
Imputation accuracy	Excellent results early on	Good but declining results over time
Cost	SkimSeek (1X + imputation) = £30 per dog	170K array = £70 per dog 710K array = £45 per dog
Data processing	Use of data	Imputation Use of data
Data storage	Low-pass sequence, Imputed data	SNP genotype, Imputed data

Take-home messages

For Guide Dogs, low-pass sequencing is the optimal strategy

- Implementing genomic selection
- Participating in the research on complex traits
- Cost-effective manner and with minimal data handling

Simulation is a tool tailored to goals to support strategic decision

This framework can be applied to other objectives and other populations

Any questions?



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