



DNA Based Breeding

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Advances in Animal Breeding Webinar

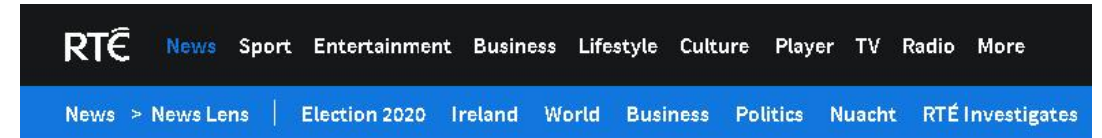
3rd March, 2021

DNA

DNA is the **same in every cell** of
your body

&

doesn't change throughout
your life



DNA evidence proves Welsh farmer stole neighbour's cow

Updated / Wednesday, 5 Feb 2020 15:54



PC Gareth Jones, the officer who took charge of the case, said his force was "proud" of its achievement

DNA

DNA = building blocks of genes

4 different nucleotides

A – Adenine

C – Cytosine

G – Guanine

T – Thymine



What is a SNP?

99.9% of our DNA is identical – most of the differences are in the form of *SNPs*



...ACGTACGTCAATGACTTTTACGTAT...

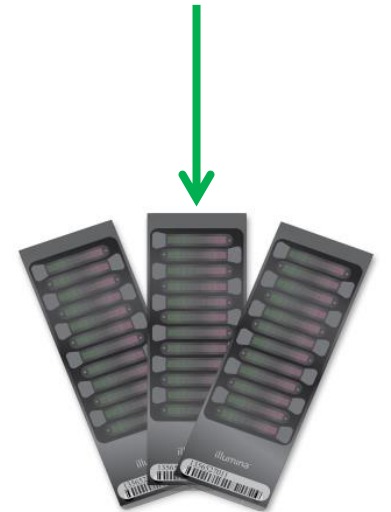


...ACGTACGACAATGACTTTTACGTAT...

Single Nucleotide Polymorphism

Change

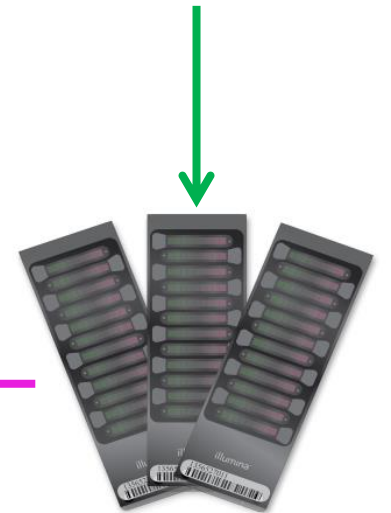
Genotyping process



Genotyping process



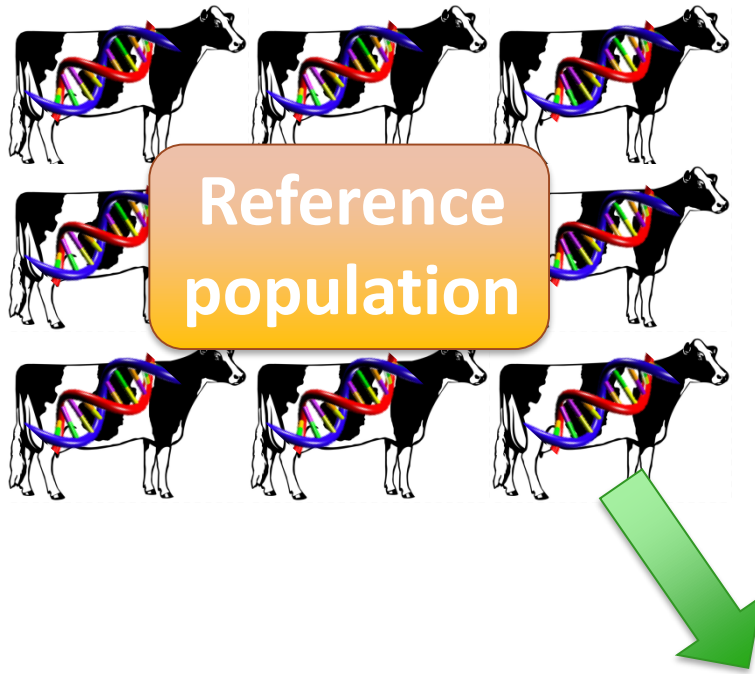
Genotyping process



Decision
support
tools



Genomic selection



Association
between SNPs
and phenotypes

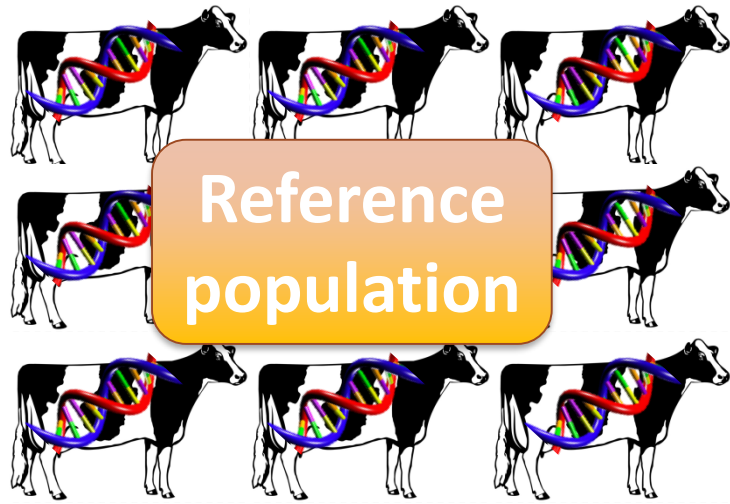


SNP	Milk	Fertility
1	+5	-0.6
2	-1.3	+0.9
3	-4.7	+0.2
4	+20	-0.4
5	+12.3	-0.6
⋮		
n	-32	+1.1



Prediction
equations

Genomic selection



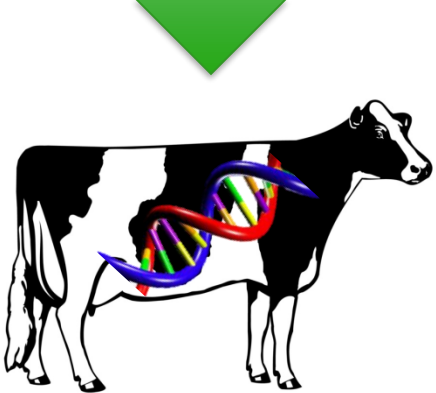
Reference
population

Prediction
equations



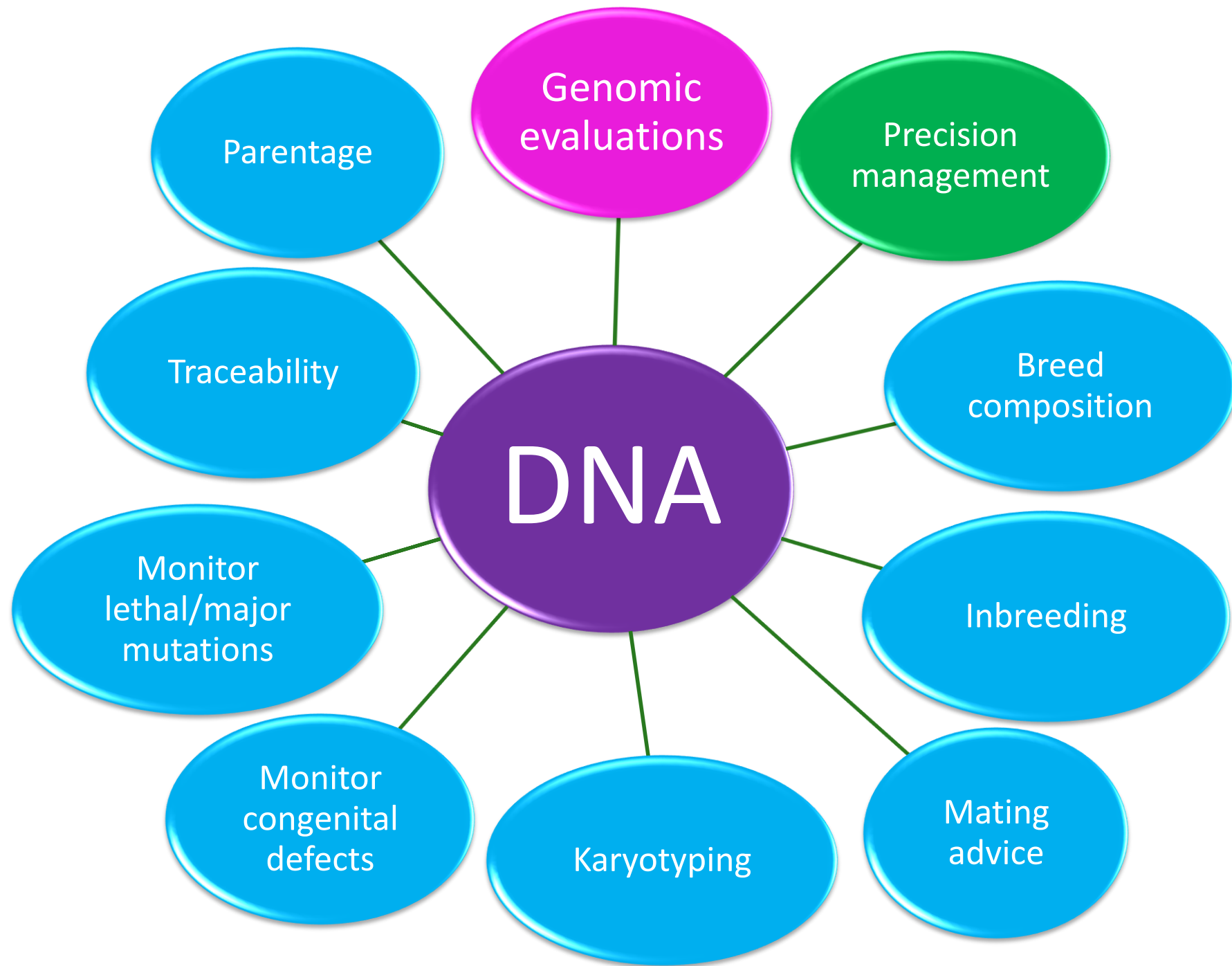
Genomic
relationship

Pedigree



Direct
genomic
value
(DGV)

Genomic
estimated
breeding
value
(GEBV)



Determining Parentage



.....TCACCGCTGAG.....
.....CAGATAGGATT.....



.....CAGATAGGATT.....
.....GTTAGCCTGTCA



The breeders equation

$$\Delta G = \frac{i \cdot r \cdot \sigma_a}{L}$$

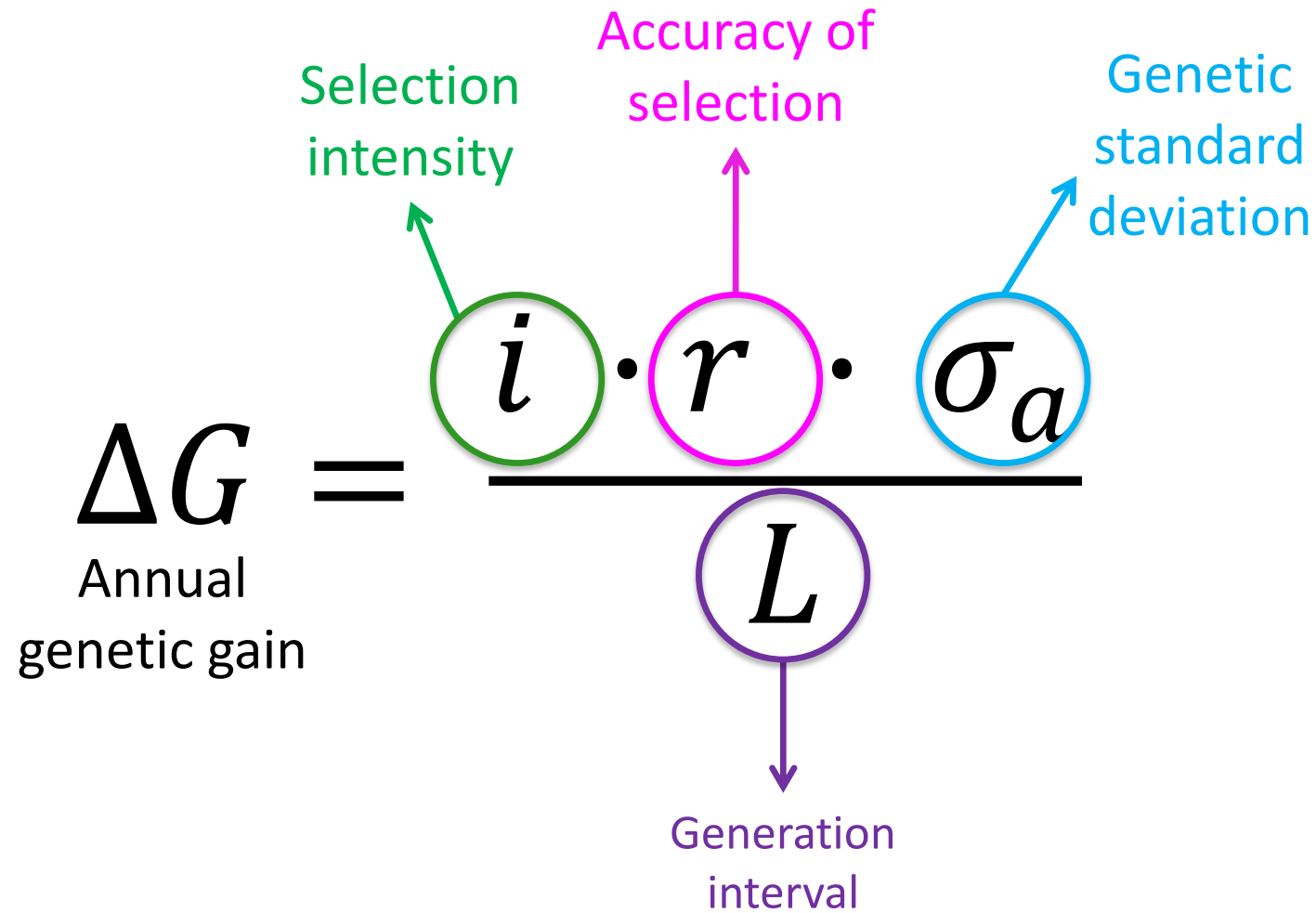
ΔG
Annual genetic gain

i
Selection intensity

r
Accuracy of selection

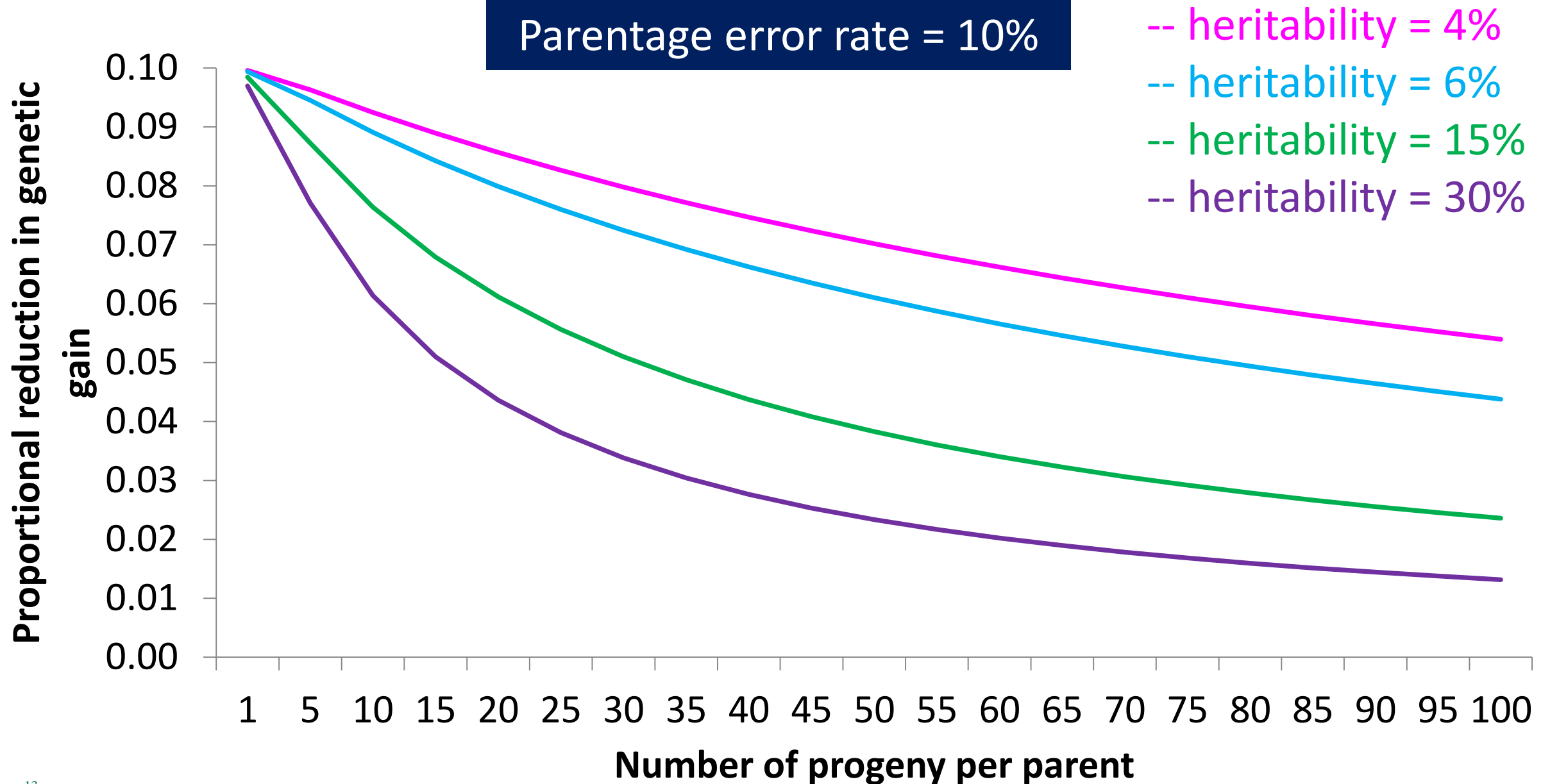
σ_a
Genetic standard deviation

L
Generation interval



The breeders equation

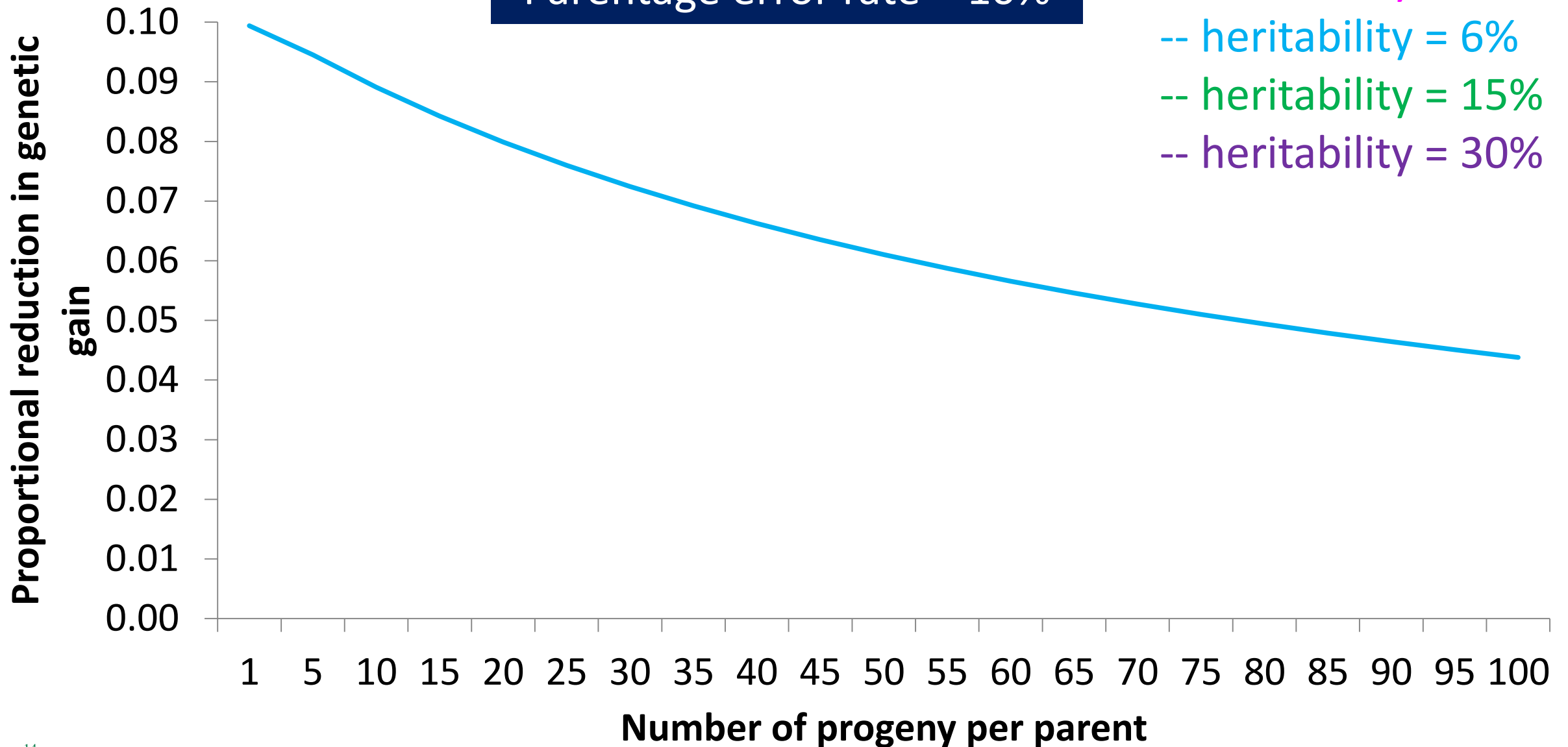
Parentage error rate = 10%



The breeders equation

Parentage error rate = 10%

- heritability = 4%
- heritability = 6%
- heritability = 15%
- heritability = 30%



Summary



Reference population

