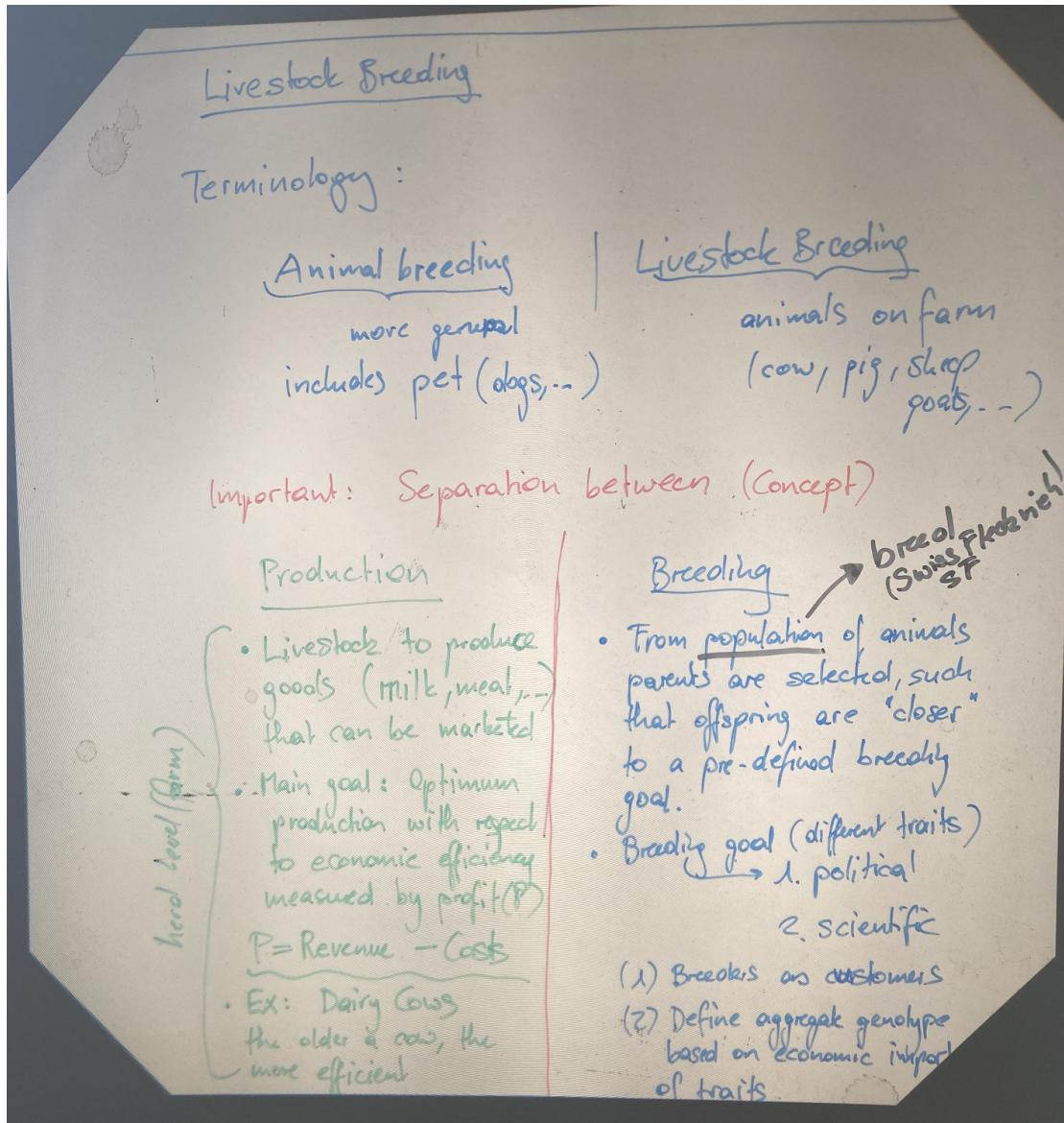
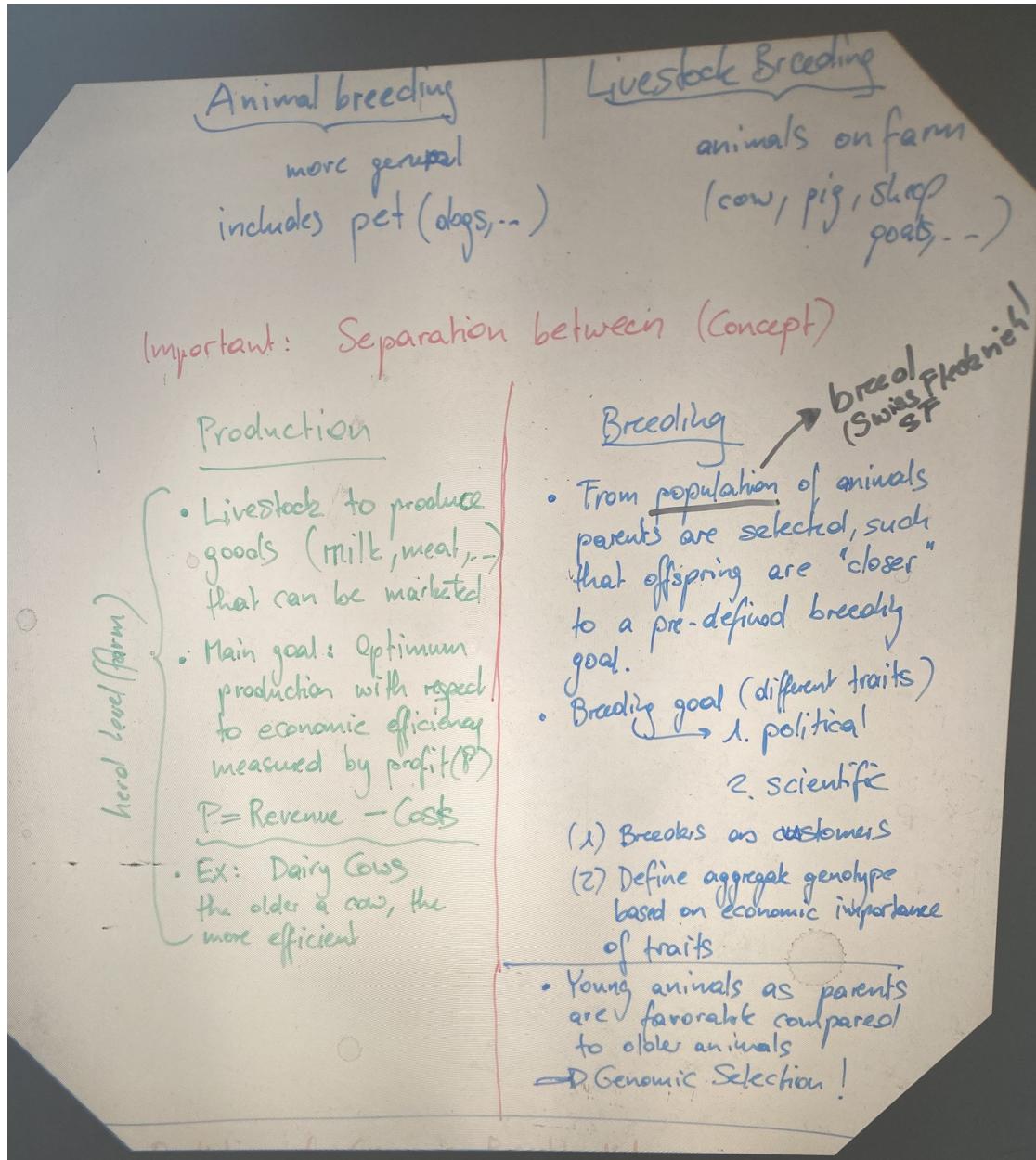


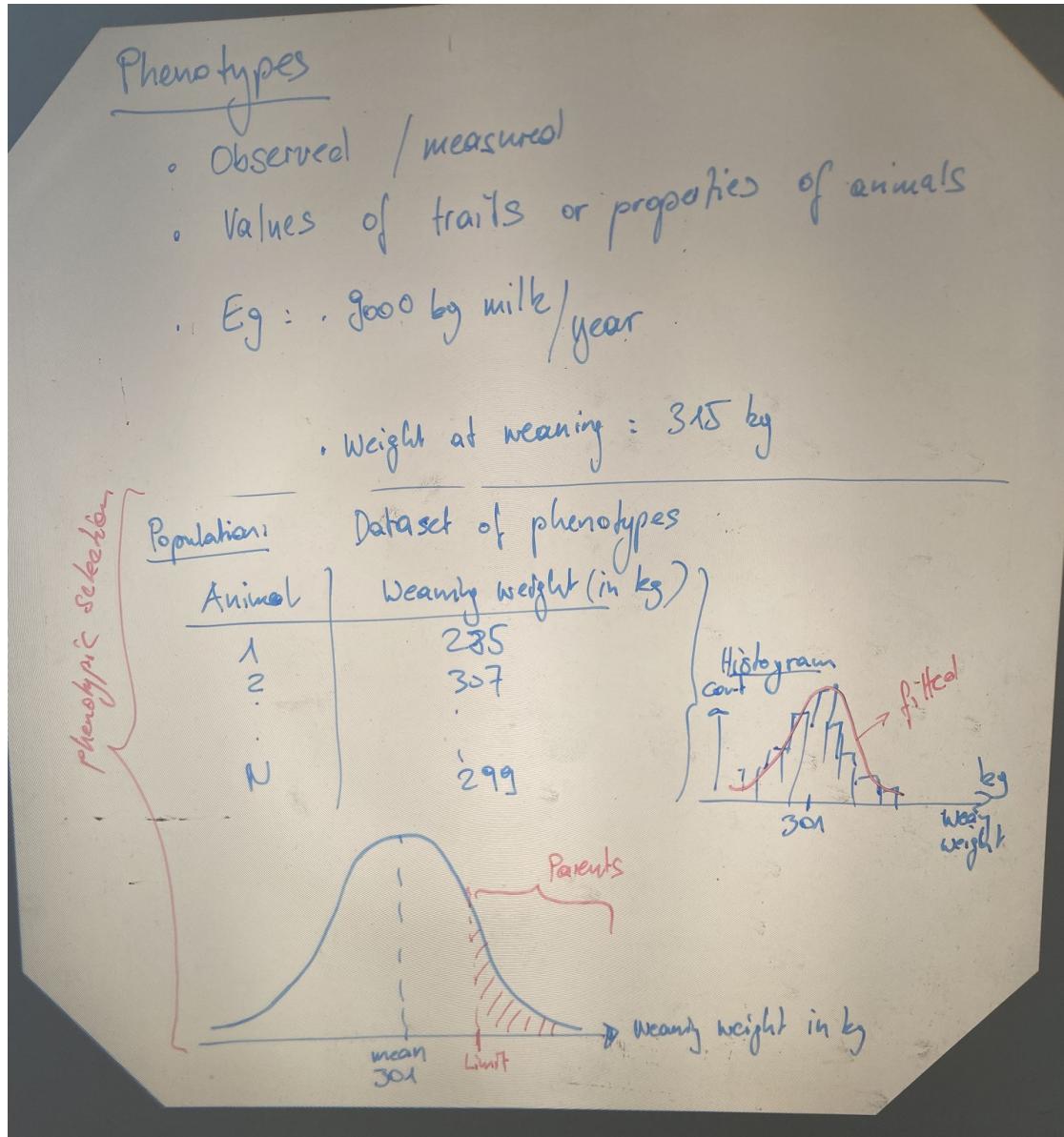
OHP Picture 1



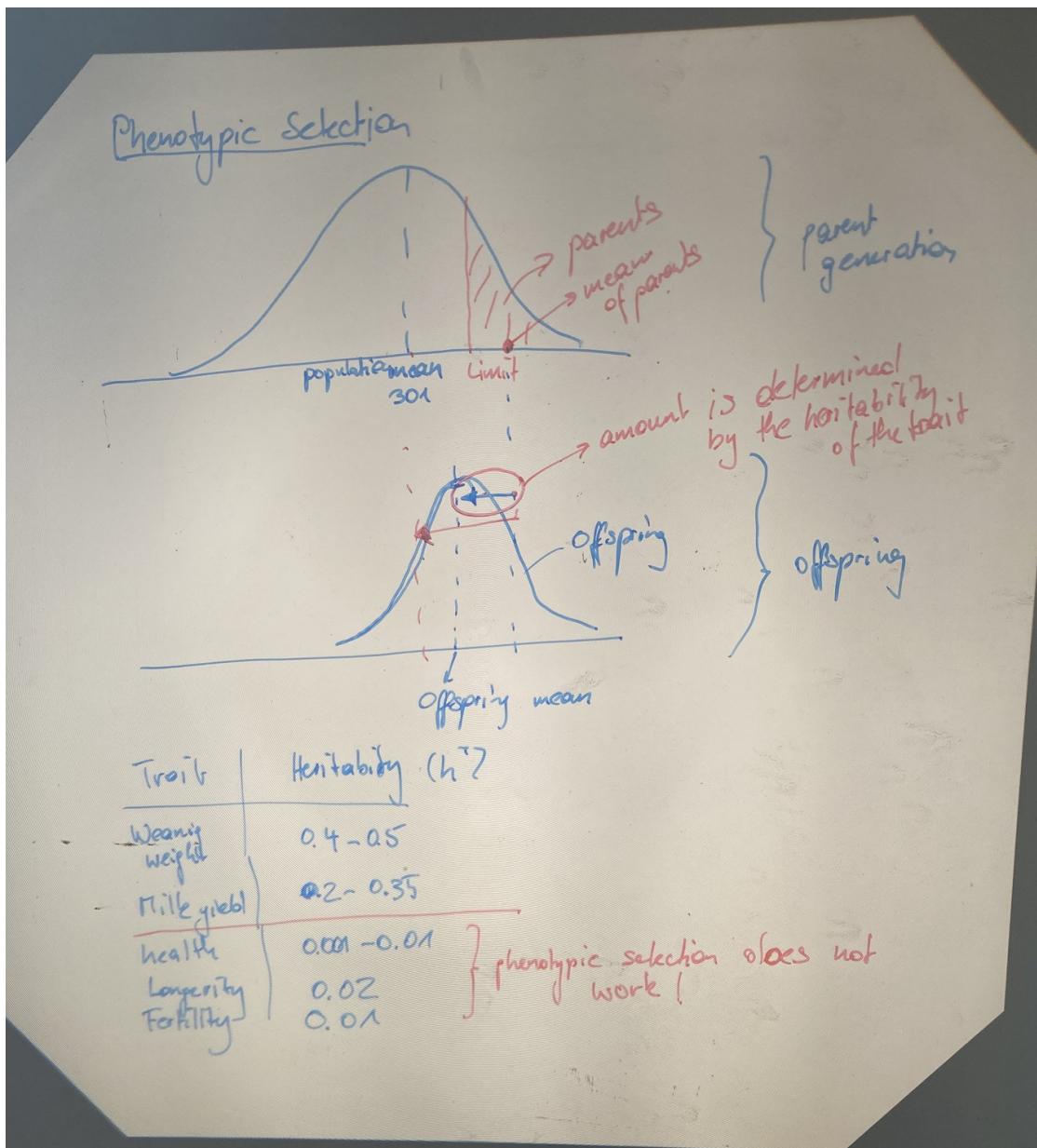
OHP Picture 2



OHP Picture 3



OHP Picture 4

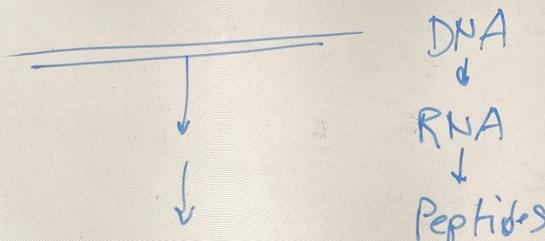


OHP Picture 5

Genetic Background

- Parents do not pass phenotypes to offspring but a random sample of their alleles/genes
- Every phenotypic observation has a genetic background, that means the set of all genes in an individual (genotype) has an effect on the expressed phenotype.

Why? \Rightarrow Central Dogma of Molecular Biology

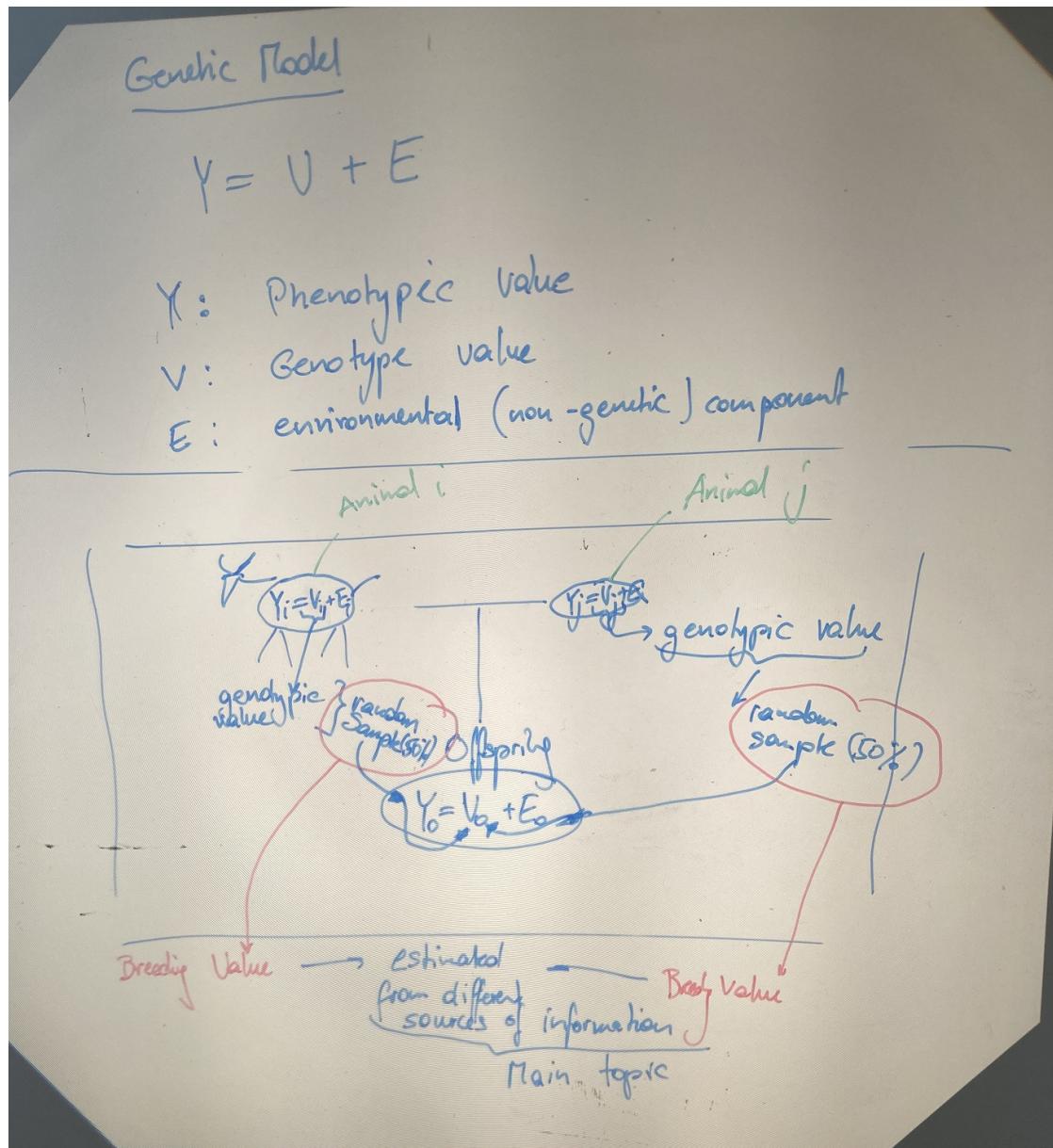


Result:

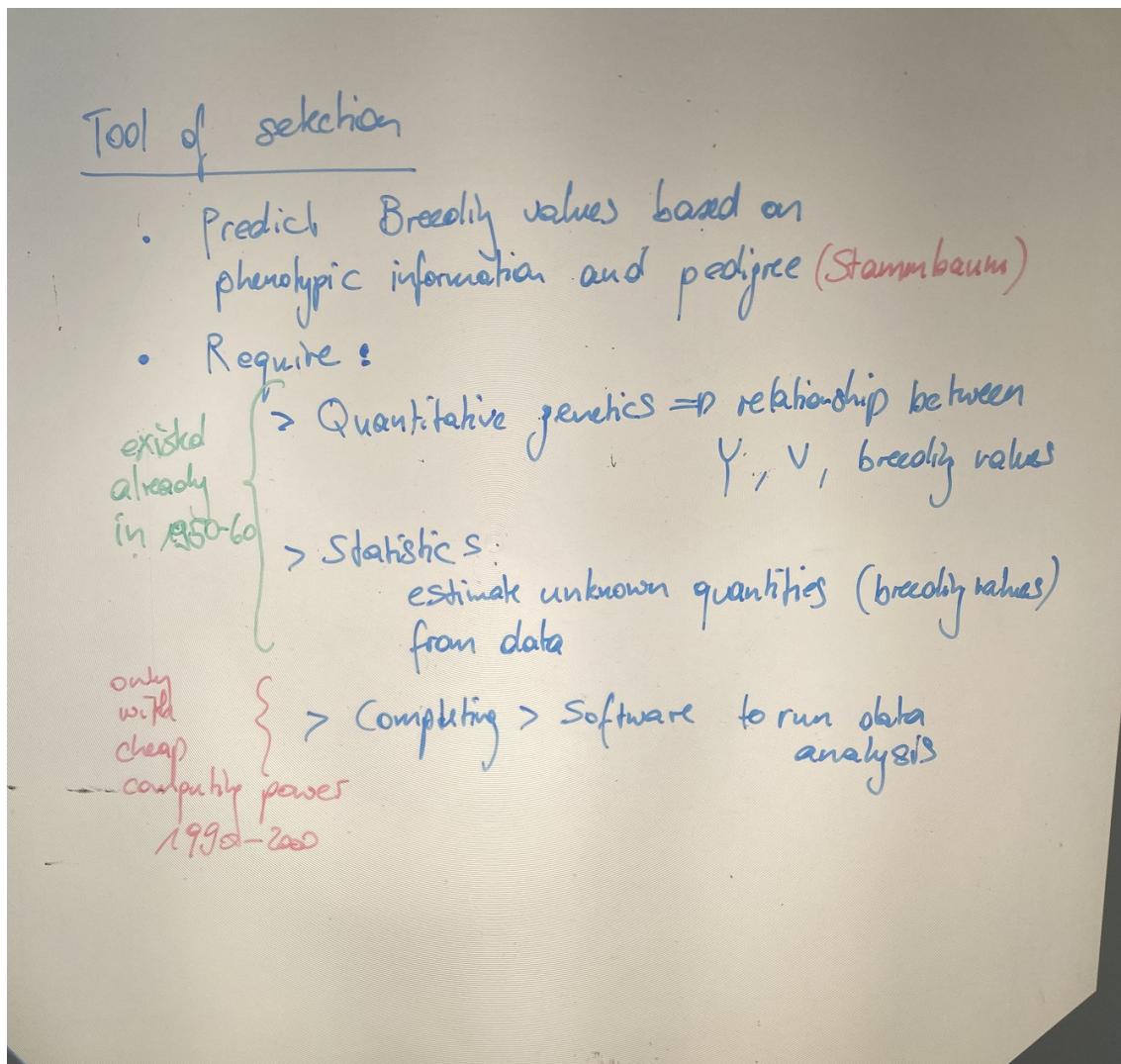
Every phenotypic observation (Y)
can be decomposed into a
genetic component (V) and
an environmental component (E)

weight
milk yield, health
methane

OHP Picture 6



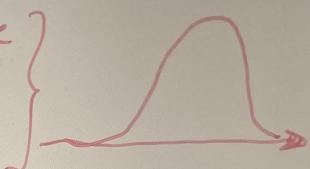
OHP Picture 7



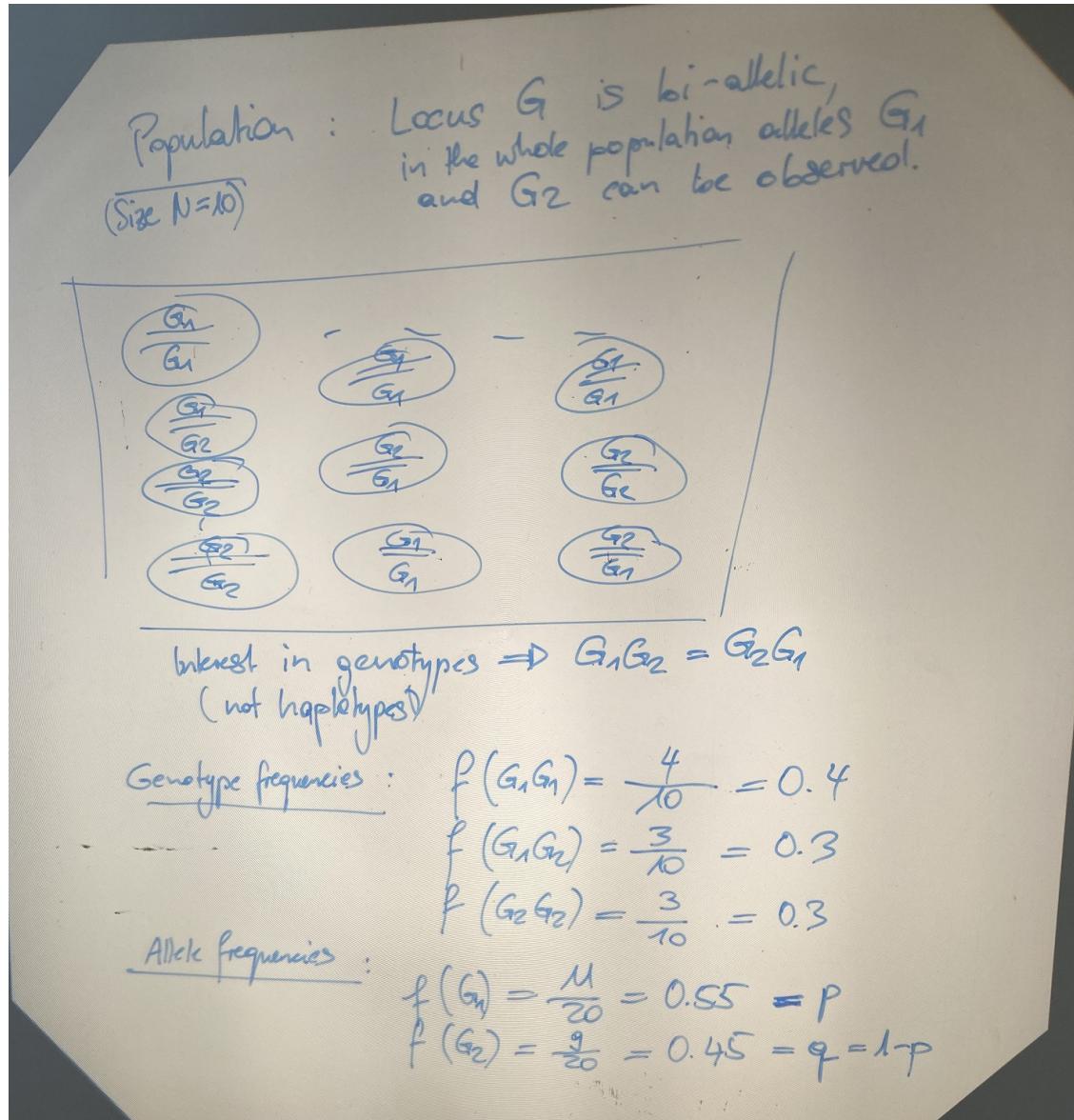
OHP Picture 8

Quantitative Genetics

Concept

- Quantitative Trait : phenotypic data available
 - measured on continuous scale
 - methane emission in g
 - weaning weight in kg
- Opposite: qualitative traits
 - discrete scale → few classes
 - healthy / diseased
 - skin color
 - litter size
 - multiple birth
- Assumption :
 - quantitative trait with values Ψ
 - is influenced by just one Locus (G)
 - that means, one position in the genome determines the genetic component (V) in our genetic model

OHP Picture 9



OHP Picture 10

Hardy - Weinberg

- idealized population
- infinite size
- no selection / random mating ..
- Given allele frequencies $f(G_1) = p$; $f(G_2) = q$
- Resulting genotype frequencies:

From parents to offspring <small>G_1G_1 - genotype as parent with frequency $f(G_1G_1) = p^2$</small>	$f(G_1G_1) = p^2$ $f(G_1G_2) = 2pq$ $f(G_2G_2) = q^2$
--	---

$G_1 G_1 \quad G_2$ $G_1 f(G_1G_1) = p^2 \cdot p \quad f(G_1G_2) = p^2 \cdot q$ $\qquad\qquad\qquad = p^3 \quad f(G_1G_2) = p^2 \cdot q$	}
--	---

G_1G_2 as parent with $f(G_1G_2) = 2pq$

$G_1 G_1 \quad G_2$ $G_1 f(G_1G_1) = pq \cdot p \quad f(G_1G_2) = pq \cdot q$ $G_2 f(G_2G_1) = pq \cdot p \quad f(G_2G_2) = pq \cdot q$	}
---	---

$G_2G_2 \dots$

Offspring
the
genotype
frequencies
remain
constant

OHP Picture 11

Given parent in HWE
 \Rightarrow Genotype frequencies are given by
 $f(G_1G_1) = p^2 ; f(G_1G_2) = 2pq ; f(G_2G_2) = q^2$

Offspring receive alleles from parents at random
 based on allele frequencies:

$$f(G_1) = f(G_1G_1) + \frac{1}{2} f(G_1G_2) \\ = p^2 + \frac{1}{2} \cdot 2pq = p(p+q) = p$$

$$f(G_2) = f(G_2G_2) + \frac{1}{2} f(G_1G_2) \\ = q^2 + \frac{1}{2} \cdot 2pq = q(q+p) = q$$

Alleles	G_1 with $f(G_1) = p$	G_2 with $f(G_2) = q$
G_1	$f(G_1G_1) = p \cdot p = p^2$	$f(G_1G_2) = p \cdot q$
G_2	$f(G_2G_1) = q \cdot p$	$f(G_2G_2) = q^2$

Genotype-frequencies Offspring

OHP Picture 12

