

OHP Picture 1

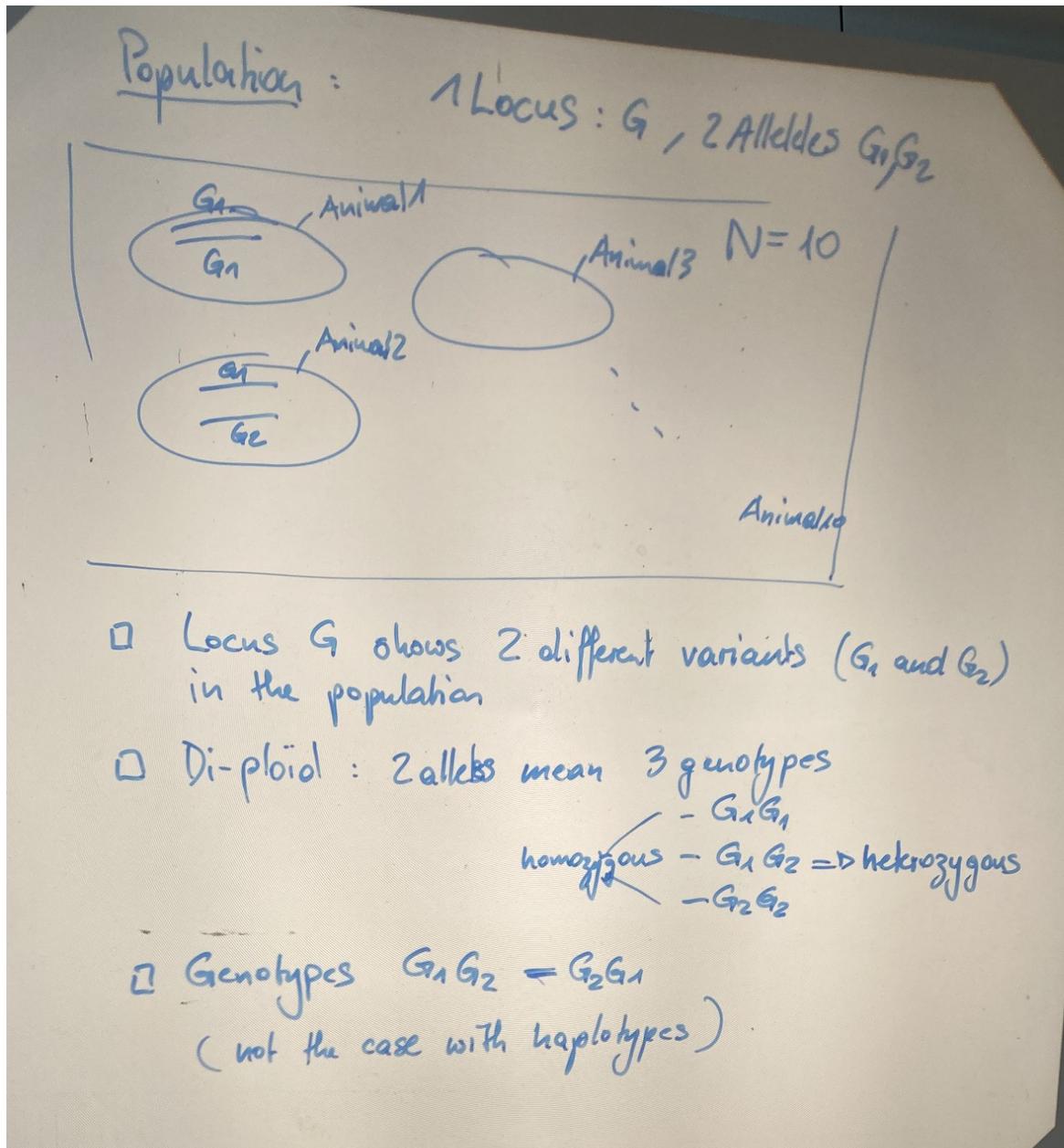
Recap:

- Decomposition of a phenotypic observation P into 2 components:
$$P = \underbrace{G}_{\text{genetic}} + \underbrace{E}_{\text{environment}}$$
 \rightarrow genetic model
understand $G!$ \rightarrow environment
Simplest model: 1 Locus
- Parents pass a random sample of their alleles to offspring
- Goal: Selection of animals as parents of future generation.

Assume: 1 Locus $\quad 1 \text{ Locus } G$

The diagram shows an oval labeled "Animal". Inside the oval, there is a horizontal line with two red dots on it, representing a single locus. The text "1 Locus G" is written above the oval, with an arrow pointing to the locus line. Below the oval, the word "Animal" is written.

OHP Picture 2



OHP Picture 3

Locus G is characterized within our population by the following quantities:

□ Genotype frequency: Rate of occurrence of each genotype in the population:

$$f(G_1G_1) = \frac{\# G_1G_1\text{-genotypes}}{N} = \frac{4}{10} = 0.4$$

$$f(G_1G_2) = \frac{3}{10} = 0.3$$

$$f(G_2G_2) = \frac{3}{10} = 0.5$$

□ Allelic frequency:

$$f(G_1) = \frac{\# G_1\text{-alleles}}{2 \cdot N} = \frac{2 \cdot 4 + 3}{20} = \frac{11}{20} = 0.55$$

$$f(G_2) = \frac{3 + 2 \cdot 3}{20} = \frac{9}{20} = 0.45$$

OHP Picture 4

□ Genotype - and Allele-frequencies give a description of the current status of a population with respect to a given locus.

□ What happens from parents to offspring?

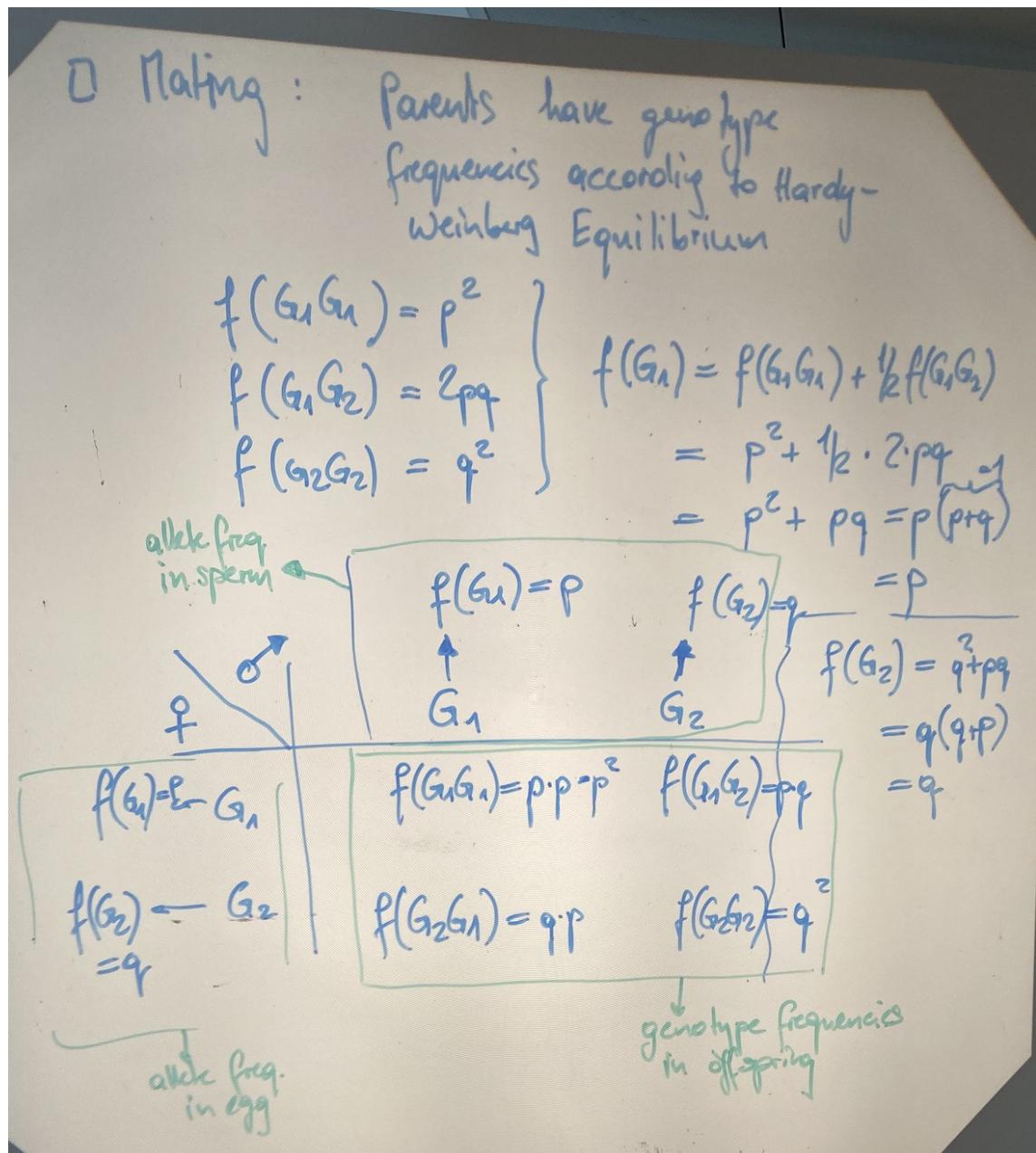
Assume : $f(G_1) = p$; $f(G_2) = q = 1-p$

Random mating : (Idealized population of infinite size)

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

$f(G_2G_2) = q^2$

OHP Picture 5



OHP Picture 6

□ Summary: Hardy Weinberg Law

1. Relationship between allele frequencies and genotype frequencies is given by

$$f(G_1) = p ; f(G_2) = q$$

$$f(G_1G_1) = p^2 ; f(G_1G_2) = 2 \cdot pq ; f(G_2G_2) = q^2$$

2. Under random mating, genotype frequencies and allele frequencies stay constant from generation to the next one.

OHP Picture 7

1.

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2.

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Adding values for phenotypic observations

phenotypic values

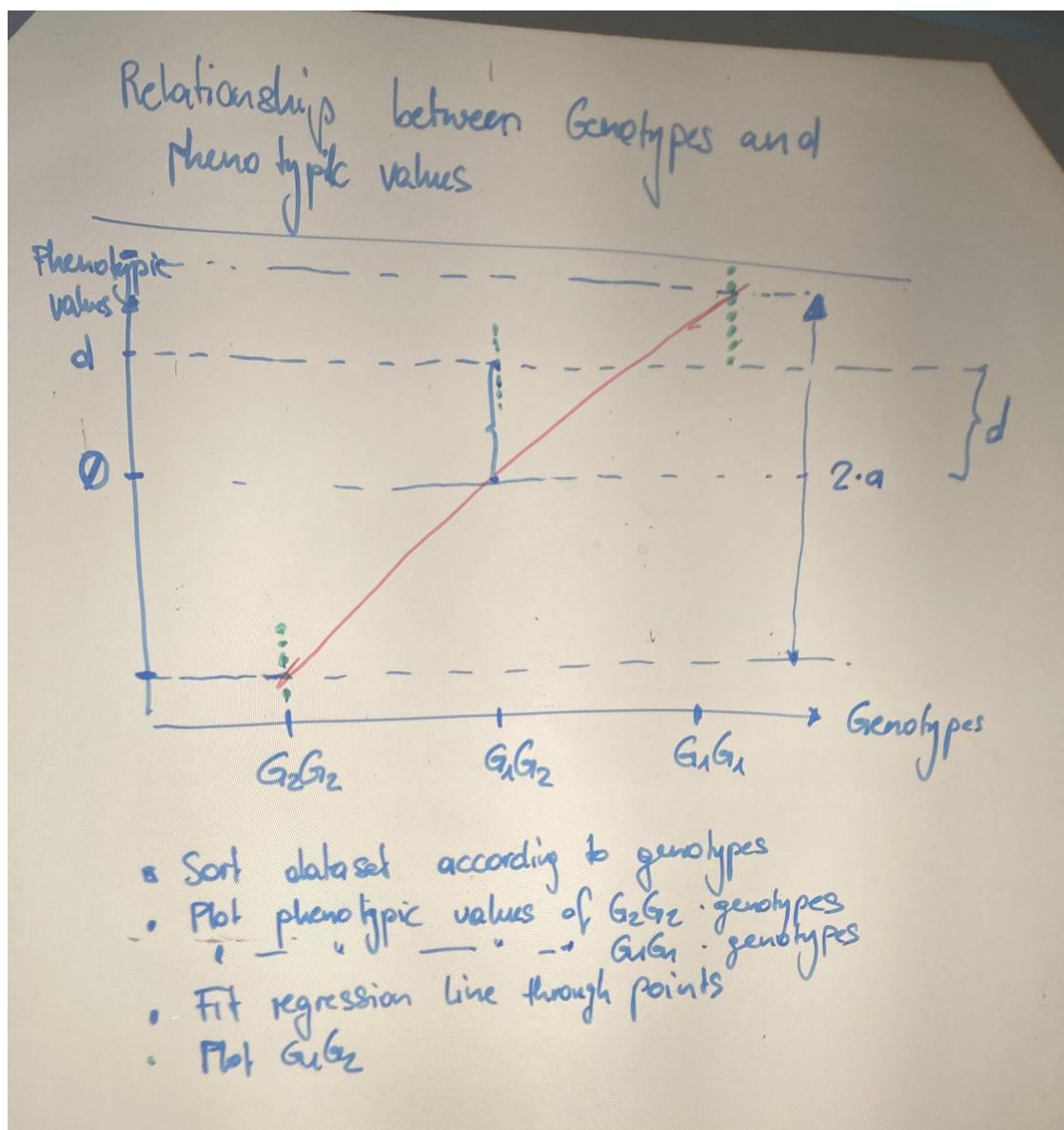
Genotypes

G_1G_2

G_1G_2

G_1G_1

OHP Picture 8



OHP Picture 9

<u>Genotypic Values</u>	
<u>Genotype</u> G_1G_1 G_1G_2 G_2G_2	<u>Genotypic Value (V)</u> $+a = V_{11}$ $+d = V_{12}$ $-a = V_{22}$
<u>Population</u>	
<ul style="list-style-type: none"> □ V is a discrete random variable □ Expected value of V: $E(V) = \boxed{V_{11} \cdot f(G_1G_1) + V_{12} \cdot f(G_1G_2) + V_{22} \cdot f(G_2G_2)}$ <p style="color: red; margin-left: 20px;">Hardy-Weinberg</p> $ \begin{aligned} &= a \cdot p^2 + d \cdot 2pq + (-a) \cdot q^2 \\ &= (p^2 - q^2) \cdot a + 2pq \cdot d \\ &= (p - q) \cdot a + 2pq \cdot d \\ &= \mu \quad (\text{mean}) \end{aligned} $ <p style="color: red; margin-left: 20px;">Population Mean</p>	

OHP Picture 10

