



UNIT 4: GENETICS

PRACTICAL 2: GENETIC CROSSES

1. Monohybrid cross: In the Kirstenbosh Botanical gardens, homozygous pink tiger lilies (dominant - P) cross with homozygous white Tiger lilies.
 - a) Show the genotypes of the parents. If a cross is made between the two flowers show the results of this cross (F1 generation) – include ALL genotypes and phenotypes of the F1 generation and show your punnet square. (17)
 - b) Show the F2 generation results – show ALL genotypes and phenotypes as well as your punnet square. What is the phenotypic ratio of the F2 generation? (18)

a. P1 (1) $PP(1)$ x $pp(1)$

Meiosis (1)

Gametes (1) $P(\frac{1}{2})$ $P(\frac{1}{2})$ $p(\frac{1}{2})$ $p(\frac{1}{2})$

Fertilization (1)

F 1- Generation(1)

	$p(\frac{1}{2})$	$p(\frac{1}{2})$
$P(\frac{1}{2})$	$Pp(\frac{1}{2})$	$Pp(\frac{1}{2})$
$P(\frac{1}{2})$	$Pp(\frac{1}{2})$	$Pp(\frac{1}{2})$

Genotype (1): All $Pp(1)$

Phenotype (1): All Pink tiger lilies (1)

b. P2 (1) $Pp(1)$ x $Pp(1)$

Meiosis (1)

Gametes(1) P $p(\frac{1}{2})$ P $p(\frac{1}{2})$

Fertilization (1)

F 1- Generation(1)

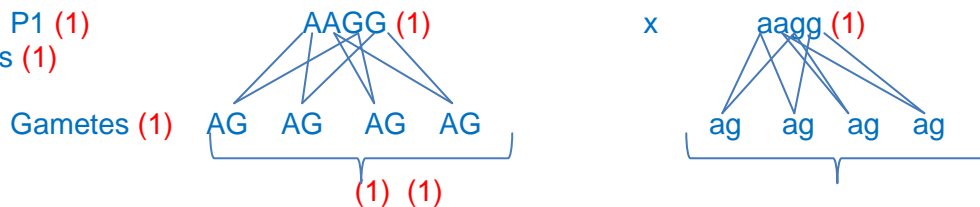
	$P(\frac{1}{2})$	$p(\frac{1}{2})$
$P(\frac{1}{2})$	$PP(\frac{1}{2})$	$Pp(\frac{1}{2})$
$p(\frac{1}{2})$	$Pp(\frac{1}{2})$	$pp(\frac{1}{2})$

Genotype: 1 x $PP(1)$; 2 x $Pp(1)$; 1 x $pp(1)$

Phenotype: 3 x Pink tiger lilies (1); 1 x White tiger lilies (1) Ratio: 3:1 (1)

2. A. Dihybrid cross: Homozygous axial plants (A-dominant) with green pods (G-dominant) are crossed with homozygous terminal plants yellow pods. Show the results of the above cross. Include the genotypes of the parents as well as the genotypes and phenotypes of the F1 generation. (16)
- B. Show the F2 generation results. Include all genotypes. (33)
- C. What is the phenotypic ratio of this cross? (1)

A. P1 (1)
Meiosis (1)



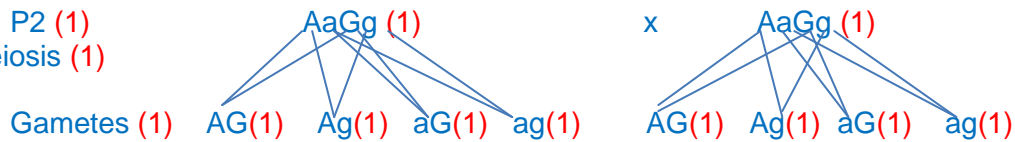
Fertilization (1)
F1-generation (1)

	AG	AG	AG	AG	(1)
ag	AaGg	AaGg	AaGg	AaGg	(1)
ag	AaGg	AaGg	AaGg	AaGg	
ag	AaGg	AaGg	AaGg	AaGg	
ag	AaGg	AaGg	AaGg	AaGg	

(1)
Genotype (1): All AaGg (1)

Phenotype (1): All axial plants with green Pods (1)

B. P2 (1)
Meiosis (1)



Fertilization (1)
F2-generation (1)

	AG	Ag	aG	ag	(1)
AG	AAGG	AAGg	AaGG	AaGg	(1)
Ag	AAGg	AAGg	AaGg	Aagg	
aG	AaGG	AaGg	aaGG	aaGg	
ag	AaGg	Aagg	aaGg	aagg	

(1)
Genotype (1): 1 x AAGG (1); 2 x AAGg (1); 2 x AaGG (1); 1 x AAgg (1); 4 x AaGg (1); 2 x Aagg (1); 1 x aaGG (1); 2 x aaGg (1); 1 x aagg (1)

Phenotype (1): 9 x Axial, Green (1); 3 x Axial, Yellow (1); 3 x Terminal, Green (1); 1 x Terminal, Yellow (1)

C. Phenotypic Ratio: 9:3:3:1 (1)

3. In humans, dark eye colour is dominant (B) while blue eyes are recessive (b). Having freckles is dominant (F) while a clear complexion (no freckles) is recessive (f). Show the dihybrid cross (using Punnett squares) between a blue-eyed mother with freckles (heterozygous for freckles) and a homozygous dark-eyed father without freckles. (25)

P1 (1)

Meiosis (1)

Gametes (1) $bF(1)$ $bf(1)$ $bF(1)$ $bf(1)$ Bf Bf Bf $Bf(1)$

Fertilization (1)

F1-generation (1)

	bF	bf	bF	bf
Bf	$BbFf$	$Bbff$	$BbFf$	$Bbff$
Bf	$BbFf$	$Bbff$	$BbFf$	$Bbff$
Bf	$BbFf$	$Bbff$	$BbFf$	$Bbff$
Bf	$BbFf$	$Bbff$	$BbFf$	$Bbff$

(1) (1) (1) (1) (1)

Genotypes (1): 8 x $BbFf$ (1); 8 x $Bbff$ (1)

Phenotypes (1): 8 x Dark eyes with Freckles (1), 8 x Dark eyes without Freckles (1)

Ratio : 1:1 (1)

4. For each phenotype below, list the genotypes

PS: Straight hair (S) is dominant to curly(s).

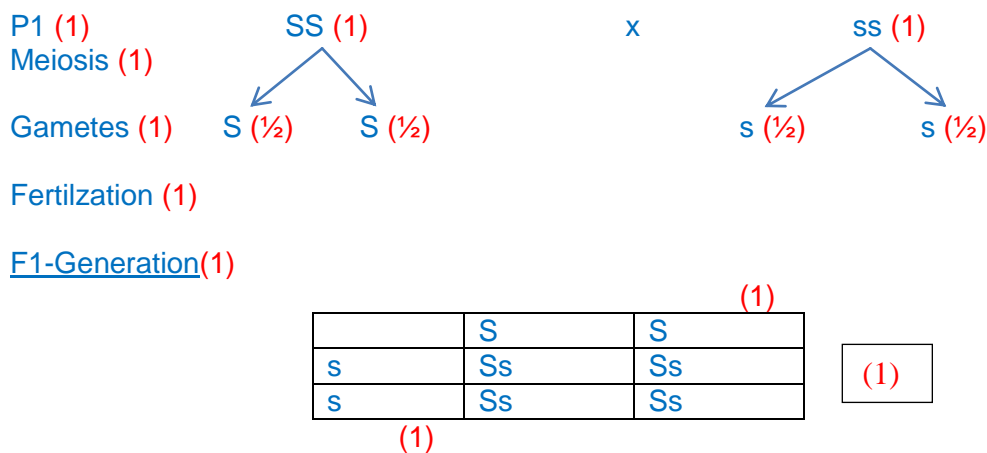
Pointed heads (P) are dominant to round heads (p).

Ss (1)/ SS (1) straight
ss(1) curly

Pp (1)/ PP (1) pointed
pp(1) round (6)

5. In guinea pigs, the allele for short hair is dominant (S).

- a. What genotype would a heterozygous short haired guinea pig have? (1)
Ss(1)
- b. What genotype would a purebreeding short haired guinea pig have? (1)
SS(1)
- c. What genotype would a long haired guinea pig have? (1)
Ss (1)
- d. Show the cross for a pure breeding short haired guinea pig and a long haired guinea pig. (16)

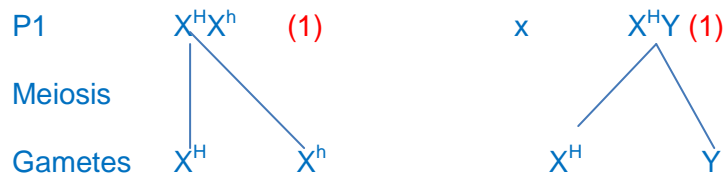


Genotypes (1): All Ss (1)

Phenotypes (1): All short haired guinea pigs (1)

- e. What percentage of the offspring will have short hair? (1)
100% (1)

6. In humans the gene for normal blood clotting, H, is dominant to the gene for hemophilia, h. This is a sex-linked trait found on the X chromosome. A woman with normal blood clotting has four children. They are a normal son, a hemophiliac son and two normal daughters. The father has normal blood clotting. What is the probable genotype for each member of the family? (10)



Fertilization

F1 generation

	X^H	X^h
X^H	$X^H X^H$	$X^H X^h$
Y	$X^H Y$	$X^h Y$

Genotypes: 1 x $X^H X^H$ (1)
 1 x $X^H X^h$ (1)
 1 x $X^H Y$ (1)
 1 x $X^h Y$ (1)

Phenotypes: 1 x Normal female (1)
 1 x Carrier normal female (1)
 1 x Normal male (1)
 1 x Hemophiliac male (1)

7. Name and state Mendel's first law of inheritance. (4)

Law of Segregation (1): Two alleles (1) for a heritable trait (1) separate during gamete formation ($\frac{1}{2}$) and end up in different gametes ($\frac{1}{2}$)

TOTAL: 150