10.2 Inheritance

Dihybrid Crosses

Solve the following questions (HINT: use Punnett Squares)

1. Some dogs bark when trailing, others are silent. The barking trait (B) is dominant over the silent trait (b). Erect ears (E) are dominant over drooping ears (e). An erect-eared barker is crossed with a droopy-eared silent trailer. Litter after litter produces pups with erect ears, but some are barkers and some are silent. What are the probable genotypes of the parents?

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2. In Cocker Spaniels, black coat (B) is dominant over red coat (b), and solid colour (S) is dominant over spotted colour (s). A solid black male is mated with a solid red female. They produce a litter of six pups: 2 solid black pups; 2 solid red pups; 1 black spotted pup; 1 red spotted pup. Determine the genotype of the parents.

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3. In fruit flies, long wings (L) are dominant over vestigial wings (l). If a vestigial winged fly is crossed with a homozygous long winged fly, what genotype and phenotype possibilities are expected in the F1 generation? In the F2 generation?

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4. In hogs, a white belt around the middle (M) is dominant over being beltless (m), and syndactyly, or fused hooves (F), are dominant over normal split hooves (f). A uniformly coloured hog that is homozygous for fused hooves is mated with a homozygous belted hog with split hooves. Determine the genotypes of the parents and the possible genotypes and phenotypes of offspring.

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5. In rabbits, short hair (K) is dominant over long hair (k), and brown hair (B) is dominant over black hair (b). A short black-haired rabbit was crossed with a long brown-haired rabbit. In four litters, 38 rabbits were produced, all with short brown hair. Determine the genotypes of the parents and the 38 offspring.

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Gene Linkage

Define linkage group

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Identify the factor that determines the likelihood of recombination between two linked genes

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Outline how Morgan discovered non-Mendelian ratios via experimentation with Drosophila

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Identify the recombinants in the following cross: $\frac{AB}{AB} \times \frac{ab}{ab}$

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Polygenic Inheritance

Define polygenic inheritance

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Distinguish between discrete and continuous variation

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List two examples of polygenic inheritance

1. ……
2. ……

Chi-Squared Test

Complete the chi-squared test to determine whether two genes are linked

Two heterozygous long green plants (LlGg) are crossed, yielding the following F1 frequencies:

296 = long green 19 = long yellow 27 = short green 85 = short yellow

1. Identify Hypotheses

Null Hypothesis: ……

Alternative Hypothesis: ……

2. Calculate Frequencies

Dihybrid Ratios:

	LG	Lg	lG	lg
LG				
Lg				
lG				
lg				

Frequencies:

Phenotype	Observed	Expected (Total × Ratio)
Long green		
Long yellow		
Short green		
Short yellow		

3. Calculate Chi-Squared Value

	Long green	Long yellow	Short green	Short yellow
$\frac{(O-E)^2}{E}$				

χ^2: ……

4. Determine Statistical Significance

Degree of Freedom	Probability of Exceeding Critical Value						
	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.584	1.212	2.366	4.11	6.25	7.81	11.34

Conclusion: ……