Independent Assortment: Dihybrid cross

THE CHI-SQUARE TEST

Dihybrid cross

- Dihybrid cross is a mating between parents that are heterozygous for two characters (dihybrids).
- F₂ progeny will show a 9:3:3:1 ratio.







Mendel's law of independent assortment

- states that each allele pair segregates independently of other gene pairs during gamete formation.
- Mendel observed that different genes assort independently of each other. It was as if each gene had its own chromosome.

(Chromosomes had not yet been discovered when Mendel was alive. The link between chromosomes and genes had not yet been made.)

Testing a dihybrid cross

- Count the number of purple starchy, purple sweet, yellow starchy and yellow sweet kernels in five of the rows on your ear of corn and record the number on the chart. Be sure to use the same five rows for each calculation.
- Make a table and but your data on.
- Calculate the percentage between the individual traits.



Testing a dihybrid test cross

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Animal Example

- In gunia pig we have:
- BB = black bb = white
- LL = short hair
 II = long hair

Bb = black

Ll = short hair



Female Gametes





Black, Short

9



Black, Long

3



White, Short

3



White, Long 1

Chi-square test

- The chi-square test is a "goodness of fit" test: it answers the question of how well do experimental data fit expectations.
- We start with a theory for how the offspring will be distributed: the "null hypothesis".
- The chi-square test: It is a statistical test that can be used to determine whether observed frequencies are significantly different from expected frequencies or not.
- First determine the number of each phenotype that have been observed and how many would be expected given basic genetic theory.
- Conclusion:
- If the observed chi-square is greater than the critical value (p value) then you would accept your null hypothesis (differences are due to random chance alone) and your genetic explanation for this trait is supported.
- If the p value is determined to be less then you would reject your null hypothesis your genetic explanation for this trait is unsupported. You therefore have to consider alternative factors influencing the inheritance of the mutant trait.

Chi Square formula $X^{2} = \sum \frac{(o-e)^{2}}{\rho} = \sum \frac{(d)^{2}}{\rho}$

- o observed count or frequency
- e expected count or frequency
- d The difference between the observations and the expected numbers

Calculating chi square

- In general the steps to solve a chi square test are:
- Calculate the degree of freedom = number of phenotypes -1.
- Calculate the expectation = number for individuals × expected percentage.
- Extract the tabled by comparing the degree of freedom column with the moral level row.(if it's not given it is usually .05).
- Put the data in the table.
- Write your conclusion by comparing the tabled with the calculated.

Example

If you have the following data calculate the chi square

phenotype	observed
round yellow	315
round green	101
wrinkled yellow	108
wrinkled green	32
total	556

phenotype	Observed (O)	expected proportion	expected number (E)	d = o - e	d2/e
round yellow	315	9/16	9/16 x 556= 312.75		
round green	101	3/16	3/16 x 556=104.25		
wrinkled yellow	108	3/16	3/16 x 556=104.25		
wrinkled green	32	1/16	1/16 x 559=34.75		
total	556	1	556		

Human Traits



Cleft Chin



Tongue Rolling



Widow's Peak





Free Earlobe









Bent Little Finger

