CHI SQUARED EVALUATION OF DATA

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GWLC 9th, pp 97-99

When evaluating results of an experiment (zB: **dihybrid cross**), how do you establish confidence in your conclusion?

frequency of recombinants = total recombinant type/total progeny = 50 % if markers are on **different chromosomes**.

But one may find **frequencies <50%**. (*I.e.*, excess of parental). Because of variability of results, are they linked?

The standard for a scientific proof is confidence of **95% (probability that the observed would *not* happen randomly**).
(0.05 probability that the observed results would happen if only by random chance).
How to evaluate the probability of the observed results being more or less than 0.05 (5% chance the results are random)

STATISTICAL TOOL TO DETERMINE PROBABILITY OF OBSERVED RESULTS: CHI SQUARED

This tool ($\chi^{2)}$ **allows one to calculate the likelihood that the results you got were by random chance**.
If it is less than 5% probability of getting these results by random chance, discard the hypothesis.

For instance, **brown eyed dad x blue eyed mom** (an example of a test cross...) Is he (brown eyed) heterozygous?

Hypothesis: he *is* heterozygous (Bb). What is the probability that he will produce *all* brown eyed progeny?:

cross	**probability of being brown-eyed:**	
1	0.5	
2	0.25	
3	0.125	
4	0.0625	
5	0.03125	**Note: less than 0.05, 0r 5%. Conclusion: 95% prob parent is homozygous**
6	0.015625	

Note that this does not PROVE that he is heterozygous, only that there is a 96.8% probability.
(Remember: there are only two possibilities, he *is* or he *is not*. Therefore: (1 - prob he *is*) = prob he is *not*.

Systematic way to test probability is to use chi squared analysis (p. 124-125)
LEARN HOW:

1) Establish null hypothesis which is all or nothing: for example: " No linkage"
2) Determine degrees of freedom (D.F.) (= number of sets of outcome minus 1)
3) Calculate X^2: $\sum$ for each of the sets: (deviation of actual from expected)^2/expected
4) Along the appropriate row for D.F. find the values of X^2 which bracket your X^2

Degrees of Freedom	Probability										
	0.95	0.90	0.80	0.70	0.50	0.30	0.20	0.10	0.05	0.01	0.001
1	0.004	0.02	0.06	0.15	0.46	1.07	1.64	2.71	3.84	6.64	10.83
2	0.10	0.21	0.45	0.71	1.39	2.41	3.22	4.60	5.99	9.21	13.82
3	0.35	0.58	1.01	1.42	2.37	3.66	4.64	6.25	7.82	11.34	16.27
4	0.71	1.06	1.65	2.20	3.36	4.88	5.99	7.78	9.49	13.28	18.47
5	1.14	1.61	2.34	3.00	4.35	6.06	7.29	9.24	11.07	15.09	20.52
6	1.63	2.20	3.07	3.83	5.35	7.23	8.56	10.64	12.59	16.81	22.46
7	2.17	2.83	3.82	4.67	6.35	8.38	9.80	12.02	14.07	18.48	24.32
8	2.73	3.49	4.59	5.53	7.34	9.52	11.03	13.36	15.51	20.09	26.12
9	3.32	4.17	5.38	6.39	8.34	10.66	12.24	14.68	16.92	21.67	27.88
10	3.94	4.86	6.18	7.27	9.34	11.78	13.44	15.99	18.31	23.21	29.59
	Nonsignificant								Significant		

5) Read the range of probabilities along the top of the table.