

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## ***LINKED GENES SCENARIOS***

### **INTRODUCTION:**

The positions of three genes on chromosomes are unknown. You are given two pure breeding (homozygous) lines and an initial cross of a DDEEFF male with a ddeeff female. Describe the appropriate genetic experiments needed to establish whether any of these traits are:

- a. autosomal or sex-linked
  
  
  
  
  
  
  
  
  
  
- b. linked on the same chromosome or unlinked

### **BACKGROUND INFORMATION:**

Consider an F1 generation as follows:

- male = AaBb
- female = AaBb

	AB	Ab	aB	ab
AB				
Ab				
aB				
ab				

### **SCENARIO ONE:**

A geneticist determined the phenotypes of the fruit flies as follows:

- DD = 856
- DR = 283
- RD = 266
- RR = 95

1. Calculate the ratio of phenotypes.
2. Perform a chi square analysis on the data:

	o	e	o-e	$(o-e)^2/e$
DD				
DR				
RD				
RR				
$\Sigma(o-e)^2/e$				

3. Null Hypothesis:
4. # of Degrees of Freedom:
5. Critical Value for 95% Probability:
6. Do you accept or reject your null hypothesis? Explain.
7. Provide an analysis of your answer to the previous question. In other words, what does the chi square analysis result tell you about the genes for A-a and B-b?

**SCENARIO TWO:**

A geneticist determined the phenotypes of the fruit flies as follows:

- DD = 665
- DR = 85
- RD = 79
- RR = 671

1. Calculate the ratio of phenotypes.

2. Perform a chi square analysis on the data:

	o	e	o-e	$(o-e)^2/e$
DD				
DR				
RD				
RR				
$\Sigma(o-e)^2/e$				

3. Null Hypothesis:

4. # of Degrees of Freedom:

5. Critical Value for 95% Probability:

6. Do you accept or reject your null hypothesis? Explain.

7. Provide an analysis of your answer to the previous question. In other words, what does the chi square analysis result tell you about the genes for A-a and B-b?

**SUMMARY:**

1. Which of the two scenarios involved linked genes?
2. For the scenario involving linked genes, identify the following:
  - a. Which two phenotypes are the parental phenotypes?
  - b. Which two phenotypes are the recombinant phenotypes?

- c. Determine the % recombination.
- d. How far apart are the genes on the chromosome?
- e. Using a ruler, draw a model of the chromosome showing the relative location of both genes. For scale, let 1 cm = 1 centimorgan.

**Percentage Points of the Chi-Square Distribution**

Degrees of Freedom	Probability of a larger value of $\chi^2$								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.115	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.297	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	0.554	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09
6	0.872	1.635	2.204	3.455	5.348	7.84	10.64	12.59	16.81
7	1.239	2.167	2.833	4.255	6.346	9.04	12.02	14.07	18.48
8	1.647	2.733	3.490	5.071	7.344	10.22	13.36	15.51	20.09
9	2.088	3.325	4.168	5.899	8.343	11.39	14.68	16.92	21.67
10	2.558	3.940	4.865	6.737	9.342	12.55	15.99	18.31	23.21
11	3.053	4.575	5.578	7.584	10.341	13.70	17.28	19.68	24.72
12	3.571	5.226	6.304	8.438	11.340	14.85	18.55	21.03	26.22
13	4.107	5.892	7.042	9.299	12.340	15.98	19.81	22.36	27.69
14	4.660	6.571	7.790	10.165	13.339	17.12	21.06	23.68	29.14
15	5.229	7.261	8.547	11.037	14.339	18.25	22.31	25.00	30.58
16	5.812	7.962	9.312	11.912	15.338	19.37	23.54	26.30	32.00
17	6.408	8.672	10.085	12.792	16.338	20.49	24.77	27.59	33.41
18	7.015	9.390	10.865	13.675	17.338	21.60	25.99	28.87	34.80
19	7.633	10.117	11.651	14.562	18.338	22.72	27.20	30.14	36.19
20	8.260	10.851	12.443	15.452	19.337	23.83	28.41	31.41	37.57
22	9.542	12.338	14.041	17.240	21.337	26.04	30.81	33.92	40.29
24	10.856	13.848	15.659	19.037	23.337	28.24	33.20	36.42	42.98
26	12.198	15.379	17.292	20.843	25.336	30.43	35.56	38.89	45.64
28	13.565	16.928	18.939	22.657	27.336	32.62	37.92	41.34	48.28
30	14.953	18.493	20.599	24.478	29.336	34.80	40.26	43.77	50.89
40	22.164	26.509	29.051	33.660	39.335	45.62	51.80	55.76	63.69
50	27.707	34.764	37.689	42.942	49.335	56.33	63.17	67.50	76.15
60	37.485	43.188	46.459	52.294	59.335	66.98	74.40	79.08	88.38

