6T/6+ Great

Dr. M. Nedwidek/Stuyvesant H.S.
Assignment #7, Due: 10/19/10

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S83PGR-02 Pd. 7

p.122 18. In tomatoes, two alleles of one gene determine the character difference of purple (P) versus green (G+) stem, and two alleles of a separate, independent gene determine the character difference of "cut" (C) versus "potato" (Po) leaves. The results for five matings of tomato plant phenotypes are as follows:

		Number of Progeny			
Mating	Parental Phenotypes	P,C	P,Po	G,C	G,Po
1	P,C × G,C	321	101	310	107
2	P,C × P,Po	219	207	64	71
3	P,C × G,C	722	231	0	0
4	P,C × G,Po	404	0	387	0
5	P,Po × G,C	70	91	86	7

a. Determine which alleles are dominant.
Purple stems and "cut" leaves are dominant.
b. What are the most probable genotypes for the parents in each cross?
Key: P=a+ C=b+ (Use this key for all matings)
G=a- Po=b-

Mating 1- P,C = a+a-, b+b-
G,C = a-a-, b+b-

	a+b+	a+b-	a-b+	a-b-
a-b+	a+a-b+b+	a+a-b+b-	a-a-b+b+	a-a-b+b-
a-b-	a+a-b+b-	a+a-b-b-	a-a-b+b-	a-a-b-b-

Pheno: 3 P,C : 1 P,Po : 3 G,C : 1 G,Po

Mating 2- P,C = a+a-, b+b-
P,Po = a+a-, b-b-

	a+b+	a+b-	a-b+	a-b-
a+b-	a+a+b+b-	a+a+b-b-	a+a-b+b-	a+a-b-b-
a-b-	a+a-b+b-	a+a-b-b-	a-a-b+b-	a-a-b-b-

Pheno: 3 P,C : 3 P,Po : 1 G,C : 1 G,Po

Mating 3- P,C = a+a+, b+b-
G,C = a-a-, b+b-

	a+b+	a+b-
a+b+	a+a+b+b+	a+a+b+b-
a+b-	a+a+b+b-	a+a+b-b-

Pheno: 3 P,C : 1 P,Po

Mating 4: P,C = a+a-, b+b+
G,Po = a-a-, b-b-

	a+b+	a-b+
a-b-	a+a-b+b-	a-a-b+b-

Pheno: 1 P,C : 1 G,C

Mating 5: P,Po = a+a-b-b-
G,C = a-a-b+b-

	a+b-	a-b-
a-b+	a+a-b+b-	a-a-b+b-
a-b-	a+a-b-b-	a-a-b-b-

Pheno: 1 P,C : 1 P,Po : 1 G,C : 1 G,Po

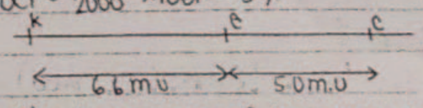
p.176 42. The recessive allele k (kidney-shaped eyes instead of wild-type round), c (cardinal-colored eyes instead of wild-type red), and e (ebony body instead of wild-type gray) identify three genes on chromosome 3 of Drosophila. Females with kidney-shaped, cardinal-colored eyes were mated with ebony males. The F1 was wild type. When F1 females were testcrossed with kk cc ee males, the following progeny phenotypes were obtained:

				$_{k}^{k}$ $_{c}^{c}$	$_{k}^{k}$ $_{e}^{e}$	$_{c}^{c}$ $_{e}^{e}$
k	c	e	3			Recombinant for loci
k	c	+	876			
k	+	e	67	R	R	
k	+	+	49	R		R
+	c	e	44	R		R
+	c	+	58	R	R	
+	+	e	899			
+	+	+	4		R	R
Total			2000	218	132	100

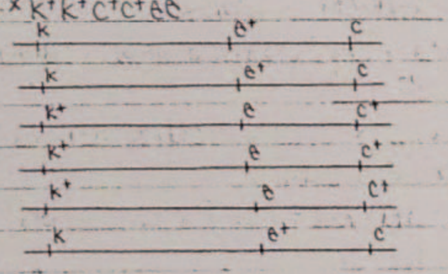
Female = +/k, +/c, +/e } +/k, +/c, +/e × k/k, c/c, e/e
Tester male = k/k, c/c, e/e } Parental input geno.: k/k, c/c, e+/e+ × k+/k+, c+/c+, e/e
For k,c : gametes k, c ; +/+ : recombinants = k+/c, c+/k
For k,e : k/e+ ; k+/e : recombinants = k/e or e+/k+

For c,e : gametes c/e+ and c+/e => c+/e+ or c/e

a. Determine the order of the genes and the map distances between them.
- k,c loci : $\frac{218}{2000} \times 100\% = 10.9\%$ (largest recombinant frequency value = farthest away)
- k,e loci : $\frac{132}{2000} \times 100\% = 6.6\%$
- c,e loci : $\frac{100}{2000} \times 100\% = 5\%$

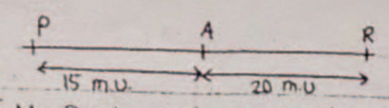


b. Draw the chromosomes of the parent and the F1.
Cross: kkccee+e+ × k+k+c+c+ee
Parents: ♀
♂
F1:



c. Calculate interference and say what you think of its significance.
I = 1 - observed frequency (# of double recombinants) / expected frequency
Expected frequency: K,E R.F = 0.066 C,E R.F = 0.05
0.066 × 0.05 = 0.0033 = 0.33%
2000 × 0.33% = 6.6 double recombinants
Observed frequency = 8 double recombinants
$I = 1 - \frac{8}{6.6} = -0.21$
INTERF = 0
A negative interference value exemplifies the occurrence of one crossover between homologous chromosomes, which makes the occurrence of a second crossover more likely.

p.177 50. The father of Mr. Spock, first officer of the starship Enterprise, came from planet Vulcan, Spock's mother came from Earth. A Vulcan has pointed ears (determined by allele P), adrenals absent (determined by A), and a right-sided heart (determined by R). All these alleles are dominant to normal Earth alleles. The three loci are autosomal, and they are linked as shown in this linkage map [note: lower cases are Earth alleles]

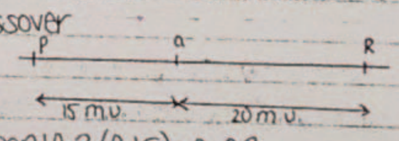


35 m.u. = 35% chance of recombination
65% chance of no recombination

If Mr. Spock marries an Earth woman and there is no (genetic) interference, what proportion of their children will have:
a. Vulcan phenotypes for all three characteristics?
Mr. Spock: PpAaRr × ppaarr ♀
Gametes: (PAR, par) (par) [Genes are linked]

	PAR	par
par	PpAaRr	ppaarr

Pheno: 1 Vulcan (all 3 characteristics) : 1 Earth (all 3 characteristics)
$\frac{1}{2}(65\%) = 32.5\%$
b. Earth phenotypes for all three characteristics? 32.5%
[Reference previous question]
c. Vulcan ears and heart but Earth adrenals?
need double crossover



double recombinant + 0.2 (0.15) = $\frac{0.03}{2}$ = 0.015 = 1.5%
Two possibilities: PaR and pAR
d. Vulcan ears but Earth heart and adrenals?
single crossover.
possibility: Par
RF of P→a = $\frac{0.15 - 0.03}{2}$ = 0.06 = 6% (0.03 represents double recombinant from previous question)

Good

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2010
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