TD 03 (Transmission of characters)

Exercise 1:

1)

Number of characters studied: 2 characters (length of the stem, color of the stem) (dihybridism).

The result of crossing a pure line long green stemmed pea plant with a short white stemmed pea plant gave 102 long green stemmed pea plants (F1) thus:

Dominant characteristics: long stem, green color

Recessive characters: short stem, white color

2)

1st crossing

T = long stem

t = short stem

G = green color

g = white color

P Homozygous long X Homozygous short

Homozygous green Homozygous white

Genotype of parents   TTGG   X   ttgg

G   TG   tg

Genotype F1   TtGg

Phenotype F1 100% long and green stem

2nd crossing F1 XF1 (self-cross between F1):

P Heterozygous long X Heterozygous long

Green heterozygous Green heterozygous

Genotype   TtGg   X   TtGg

 G 1 /4XL 1/4TG 1/4TG 1/4TG   x   1/4XL 1/4TG 1/4TG 1/4TG

F2

	TG	Tg	tG	tg
TG	TTGG	TTGg	TtGG	TtGg
Tg	TTGg	TTgg	TtGg	Ttgg
tG	TtGG	TtGg	ttGG	ttGg
tg	TtGg	Ttgg	ttGg	ttgg

Genotypes :   Phenotypes :
1/16 TTGG: long and green:
2/16 TTGg : long, green:
4/16 TtGg long and green:
2/16 TtGG long, green:
1/16 TTgg   long and white:
2/16 Ttgg long, white:
1/16 ttGG short and green:
2/16 ttGg short, green:
1/16 ttgg short and white:

Phenotypes :
Long and green : 9/16
Long and white : 3 /16
Short and green: 3/16
Short and white: 1/16

3)

P Heterozygous long X Homozygous short

Heterozygous green Homozygous white

Genotype   TtGg   X   ttgg

G   1/ 4TG 1 /4Tg 1/ 4TG 1 /4Tg   x   tg

F1

	tg	Genotypes : Phenotypes :
1/4 TG	TtGg	1/4 TtGg long and green:
1/4 Tg	Ttgg	1/4 Ttgg long, white:
1/4 tG	ttGg	1/4 ttGg short, green:
1/4 tg	ttgg	1/4 ttgg short and white:

Note: the phenotypes section continues in the same box:

Phenotypes Obtained :
26/102 long and green: = 1/4 (parental type)
25/102 long, and white: = 1/4 (recombinant type)
26/102 short and green: = 1/4 (recombinant type)
25/102 short and white: = 1/4 (parental type)

-- What is this test called?

Dihybrid test-cross

-- It allows to see if the two genes studied are linked or not (located on the same chromosome or each on a different chromosome). Here the experimental results are in favor of the independent assortment of the characters (i.e. the two genes are carried by a different chromosome

4)

P Homozygous long X Heterozygous long

Green heterozygous Green heterozygous

Genotype   TTGg   X   TtGg

G   1/ 2XL 1 /2XL   x   1/4XL 1/4XL 1/4TG 1/4XL

F1

	1/2 TG	1/2 Tg	Genotypes : Phenotypes :
1/4 TG	1/8 TTGG	1/8 TTGg	1/8 TTGG long and green
1/4 Tg	1/8 TTGg	1/8 TTgg	2/8 TtGg : long and green
1/4 tG	1/8 TtGG	1/8 TtGg	1/8 TtGG long, green
1/4 tg	1/8 TtGg	1/8 Ttgg	2/8 TTGg long, green

Additional genotypes/phenotypes listed in the box:

1/8 Ttgg long, white
1/8 TTgg long and white

Phenotypes :
Long green: 6/8 = 3/4 Long white: 2/8 = 1/4

Exercise 2

b+: gray body

b : black body

vg + : normal wings

vg : vestigial wings

P Heterozygous gray body X Homozygous black body

Heterozygous normal wings Homozygous vestigial wings

Genotype   b+ vg+ / bvg_   X   bvg / bvg_

G   b+vg + , b +vg ,   bvg + bvg   x   bvg

F1

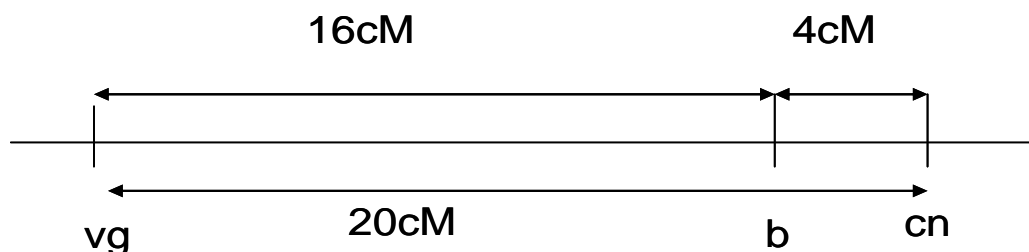|	bvg	Genotypes : Phenotypes obtained
b+vg +	b+vg +/ bvg	b+vg +/ bvg gray body , normal wings (450/1050, 43%)
b+vg	b+vg / bvg	b+vg / bvg gray body , vestigial wings (90/1050, 8%)
bvg +	b vg +/ bvg	b vg +/ bvg black body , normal wings (85/1050, 8%)
bvg	bvg / bvg	bvg / bvg black body, vestigial wings (425/1050, 41%)

Genotypes :   Phenotypes obtained
b+vg +/ bvg gray body , normal wings (450/1050, 43%)
b+vg / bvg gray body , vestigial wings (90/1050, 8%)
b vg +/ bvg black body , normal wings (85/1050, 8%)
bvg / bvg black body, vestigial wings (425/1050, 41%)

Phenotypes :
gray body and normal wings + black body and vestigial wings > 50% (parental types)
gray body and vestigial wings + black body and normal wings <50% (recombinant types)

Given the proportions of the cross test, the 2 genes are linked (parental types >50% and recombinant types <50%). We have 2 majority categories and not 4 X ¼.

2) The recombination frequency allows us to determine the distance between these 2 characters:

FR= number of recombinant types/total number=85+90/1050 X 100= 16.6% 16.6 cM= distance b- vg

3) genetic map

16cM   4cM

vg   20cM   b   cn

Exercise 3

10cM	15cM	10cM

B   C   35cM   D   A