Solution key - 7.012 Recitation 4 - 2010

Questions:

1. Tomato plants can be **tall** or **short** and have **notched** or **smooth** leaves. You cross a tall, smooth leafed plant with a short, notched leafed plant. All of the progeny are **tall**, and **notched** leafed.

1. Tomato plants can be **tall** or **short** and have **notched** or **smooth** leaves. You cross a tall, smooth leafed plant with a short, notched leafed plant. All of the progeny are **tall**, and **notched** leafed.

i. Which traits are dominant and which are recessive?

*Dominant traits are **tall** and **notched** whereas the recessive traits are **short** and **smooth.***

ii. What are the genotypes of the two **true-breeding** parents? *Use the letters H or h to represent the alleles of the height gene and the letters S or s to represent the alleles of the leaf gene. In each case, use the uppercase letter for the allele associated with the dominant phenotype and the lower case letter for the allele associated with the recessive phenotype.*

*Tall, smooth leaf parent plant will have the **genotype HHss** whereas short, notched leaf parent plant will have the **genotype hhSS**.*

b) Two tall, notched F1 plants (genotype: HhSs) were crossed.

i. Diagram this cross.

	HS	Hs	hS	hs
HS	HS HS Tall, notched	HS Hs Tall/notched	HS hS Tall/notched	HS hs Tall/notched
Hs	Hs HS Tall/notched	Hs Hs Tall/smooth	Hs hS Tall/notched	Hs hs Tall/smooth
hS	hS HS Tall/notched	hS Hs Tall/notched	hS hS short/notched	hS hs short/notched
hs	hs HS Tall/notched	hs Hs Tall/smooth	hs hS short/notched	hs hs Short/smooth

ii. If these two traits are **unlinked**, what ratio of phenotype do you expect in the F2 generation?

Tall and notched (9): tall and smooth (3): short and notched (3): short and smooth (1)

2. In fruit flies, the "B/b" gene and the "G/g" gene are linked. In one specific fly whose genotype is GgBb, "B" is linked to "g" on the maternal chromosome #2, and "b" is linked to "G" on the paternal chromosome #2.

i. List all parental type (non-recombinant) gametes by genotype that could be produced by this GgBb fly.

Non-recombinant gametes are Bg and bG.

ii. List all recombinant gametes by genotype that could be produced by this GgBb fly.

Recombinant gametes are BG and bg.

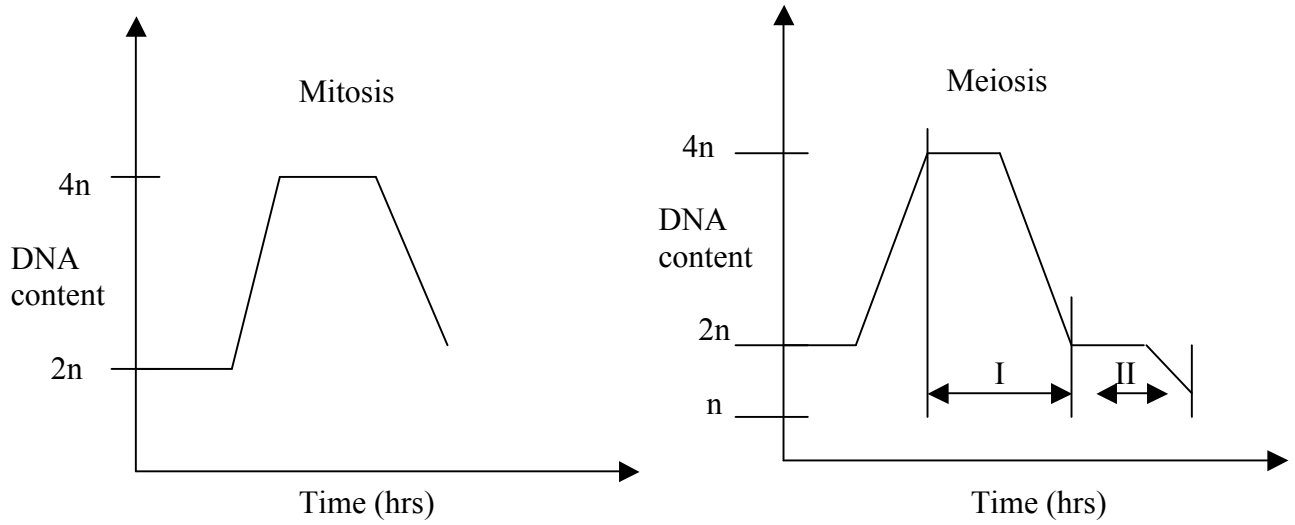
iii. Say that 40% of all gametes produced by the GgBb fly are "Bg." What percentage of all gametes produced by this fly are recombinants?

20% of the gametes are recombinants.

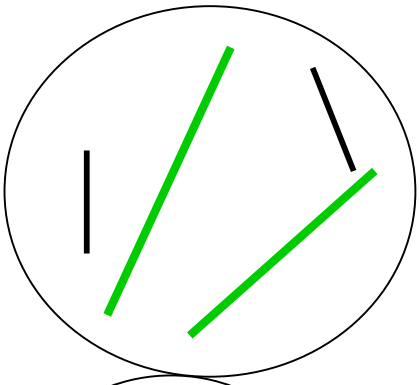
iv. As the recombination frequency between two genes on the same chromosome rises, does the physical distance between those two genes decrease **or** increase?

Physical distance is directly proportional to the recombination frequency. So the distance increases with the increase in recombination frequency.

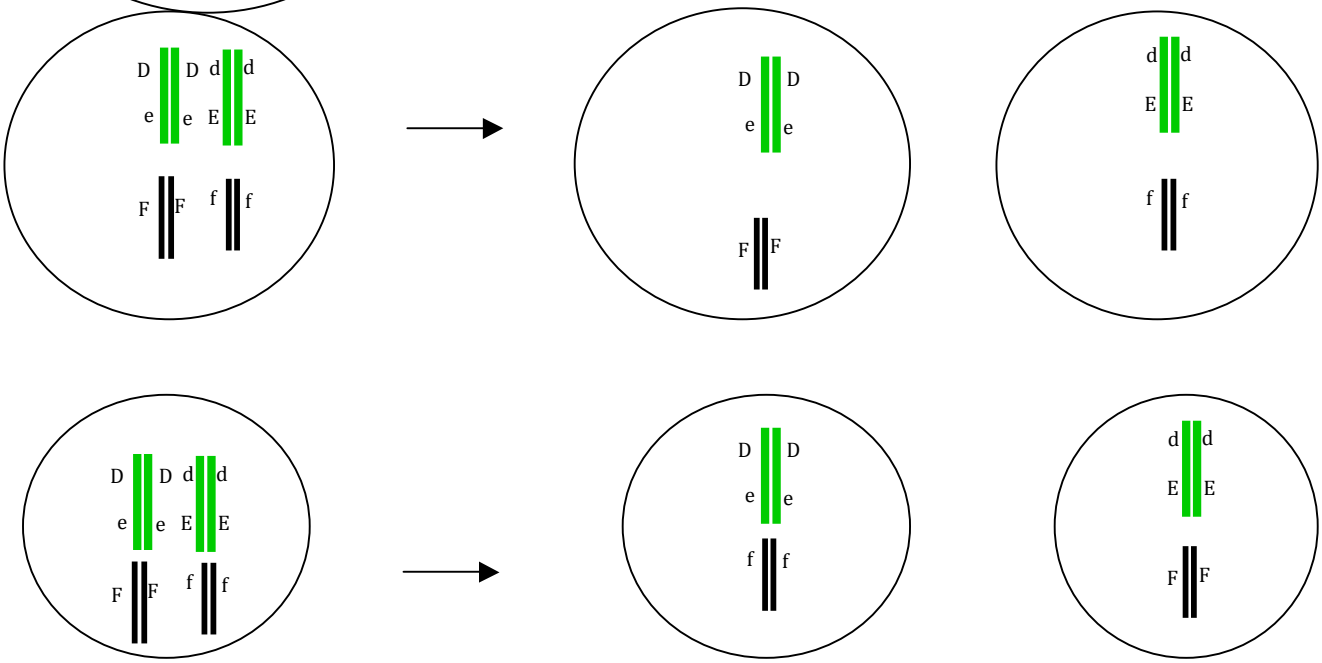
3. In a diploid cell (2n), that is undergoing cell division, draw a graph showing the variation in the DNA content (n = haploid) against time for the mitosis and meiosis.



4. A schematic of a diploid nucleus prior to DNA replication is drawn below. It contains two pairs of chromosomes (2n = 4).



The genotype of the cell above is DdEeFf, where the D and E loci are on the large chromosome and the F locus is on the small chromosome. This cell was taken from an F1 organism that resulted from the cross of two true-breeding parents such that Parent 1 is DDeeFF and Parent 2 is ddEEff. Draw and align the chromosomes as they could be when in metaphase of meiosis I. Include the D, d, E, e, F, and f alleles on the drawing and assume no recombination. Given your drawing, draw the chromosomes in each of the two products resulting from meiosis I. Include the D, d, E, e, F, and f alleles on the drawing.



i) Metaphase of meiosis I

ii) Product 1 of meiosis I

Product 2 of meiosis I