



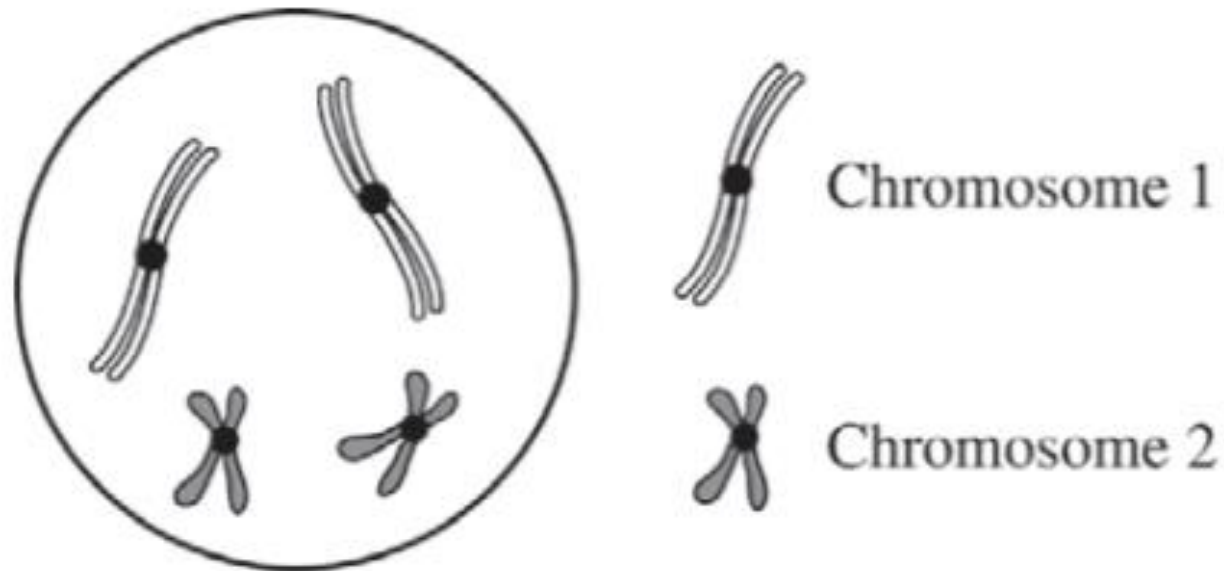
AP Bio FRQ Fridays

2016 #7
Meiosis, Testcross, & Linkage

FRQ Friday #14

2016 #7

In a certain species of plant, the diploid number of chromosomes is 4 ($2n = 4$). Flower color is controlled by a single gene in which the green allele (G) is dominant to the purple allele (g). Plant height is controlled by a different gene in which the dwarf allele (D) is dominant to the tall allele (d). Individuals of the parental (P) generation with the genotypes $GGDD$ and $ggdd$ were crossed to produce F_1 progeny.



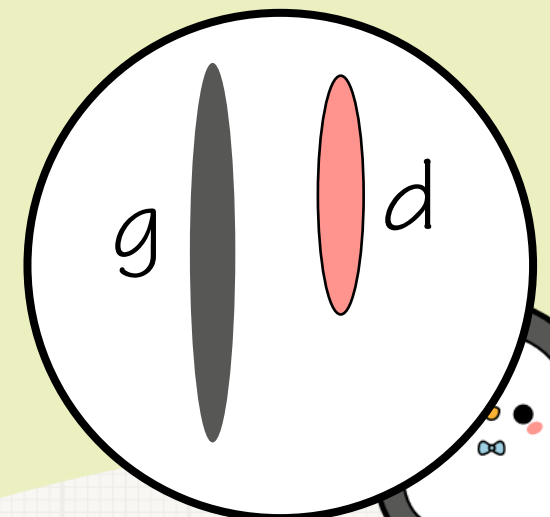
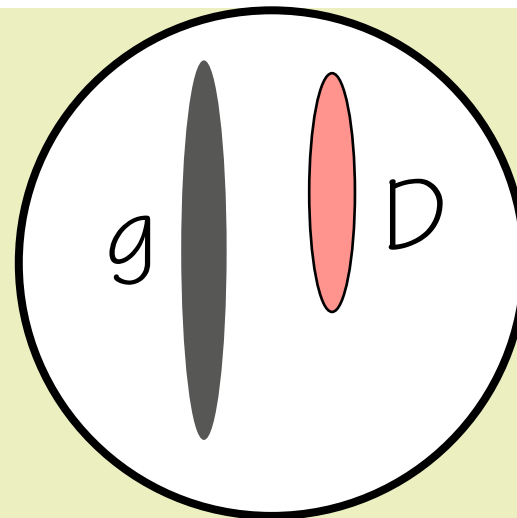
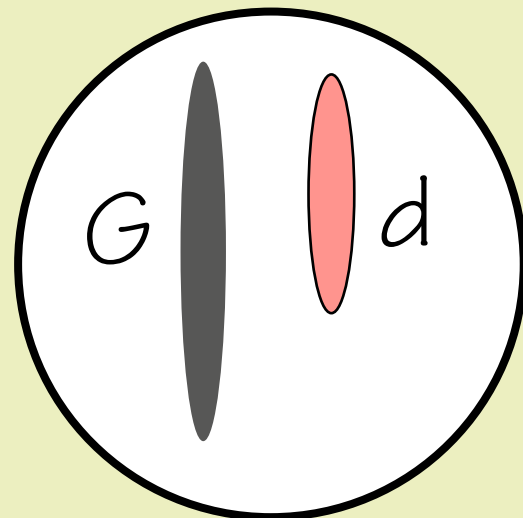
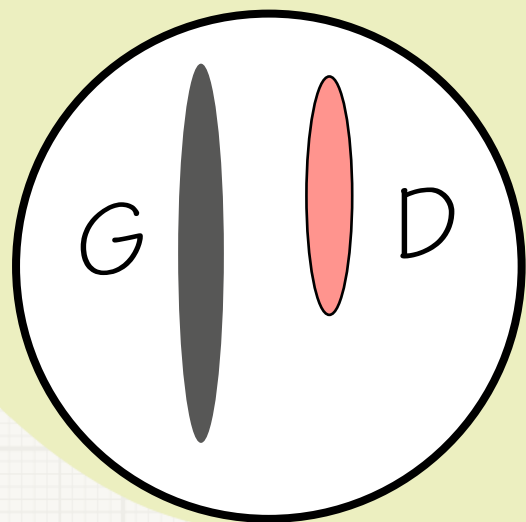
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$$F_1 = GgDd$$

- (a) **Construct** a diagram below to depict the four possible normal products of meiosis that would be produced by the F_1 progeny. Show the chromosomes and the allele(s) they carry. Assume the genes are located on different chromosomes and the gene for flower color is on chromosome 1. (1 point)



Hi!

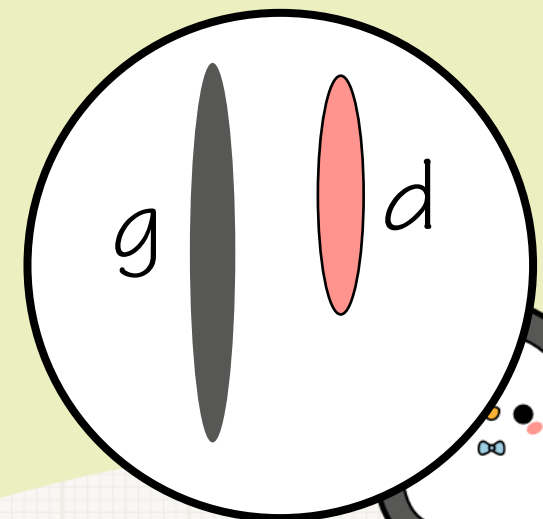
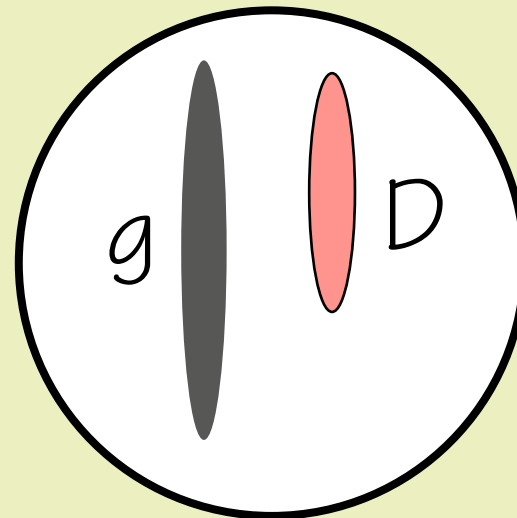
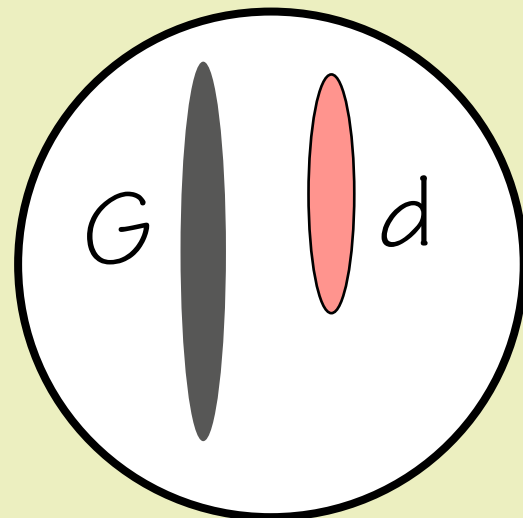
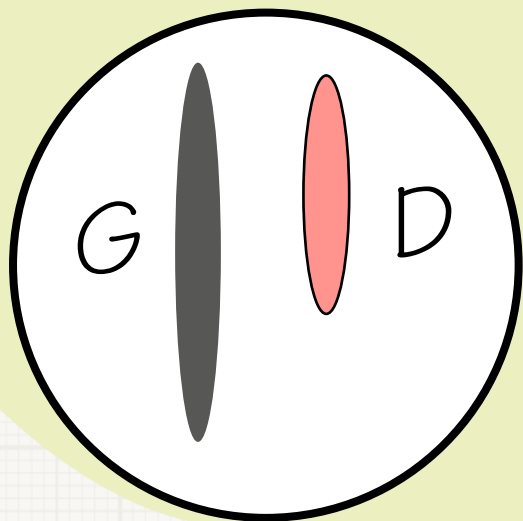
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- (a) **Construct** a diagram below to depict the four possible normal products of meiosis that would be produced by the F_1 progeny. Show the chromosomes and the allele(s) they carry. Assume the genes are located on different chromosomes and the gene for flower color is on chromosome 1. **(1 point)**

Construct diagram (1 point)

- Diagram must include all of the following:
 - Each cell has one unduplicated chromosome 1 (with G or g).
 - Each cell has one unduplicated chromosome 2 (with D or d).
 - Genotype combinations should be: GD, Gd, gD, gd.

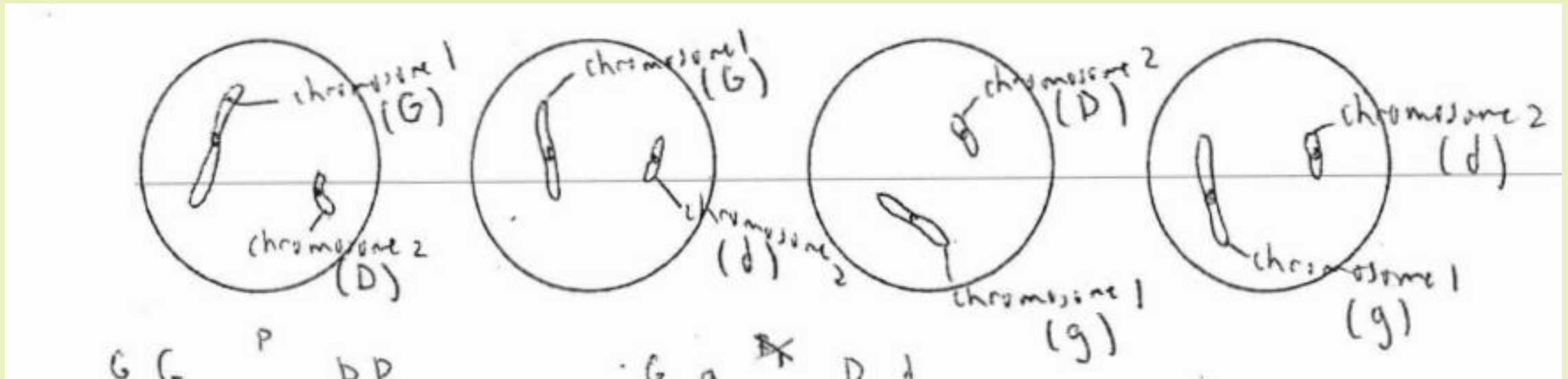


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FRQ Friday #14

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- (a) **Construct** a diagram below to depict the four possible normal products of meiosis that would be produced by the F_1 progeny. Show the chromosomes and the allele(s) they carry. Assume the genes are located on different chromosomes and the gene for flower color is on chromosome 1. **(1 point)**



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(b) **Predict** the possible phenotypes and their ratios in the offspring of a testcross between an F_1 individual and a $ggdd$ individual. (1 point)

Test Cross = $GgDd \times ggdd$

	G	g	
g	Gg	gg	1/2 Green 1/2 Purple
g	Gg	gg	

	D	d	
d	Dd	dd	1/2 Dwarf 1/2 Tall
d	Dd	dd	

Green Dwarf = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$
Green Tall = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Purple Dwarf = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$
Purple Tall = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Prediction (1 point)

- 1 green dwarf: 1 green tall: 1 purple dwarf: 1 purple tall



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Prediction (1 point)

- 1 green dwarf: 1 green tall: 1 purple dwarf: 1 purple tall

Handwritten genetic cross diagram:

P: $GGDD$ (green tall) \times $ggdd$ (purple dwarf)

\rightarrow F_1 : $GgDd$ (green tall) \times $ggdd$ (purple dwarf)

Offspring phenotypes and ratios:

- green dwarf: $\frac{2}{4} \left(\frac{2}{4} \right) = \frac{4}{16}$
- purple dwarf: $\frac{2}{4} \left(\frac{2}{4} \right) = \frac{4}{16}$
- green tall: $\frac{2}{4} \left(\frac{2}{4} \right) = \frac{4}{16}$
- purple tall: $\frac{2}{4} \left(\frac{2}{4} \right) = \frac{4}{16}$

Final ratio: green dwarf = green tall = purple dwarf = purple tall ratio is $1:1:1:1$



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- (c) If the two genes were genetically linked, **describe** how the proportions of phenotypes of the resulting offspring would most likely differ from those of the testcross between an F_1 individual and a $ggdd$ individual. (1 point)

Identify difference (1 point)

- The majority/greater than 50 percent would have the parental plant phenotypes
- Greater than 25 percent would be green dwarf plants and greater than 25 percent would be purple tall plants
- Less than 25 percent would be green tall plants and less than 25 percent would be purple dwarf plants

if the genes were linked then there would be a lot more
green dwarf and purple tall plants in the resulting offspring
of $F_1 \times ggdd$ and the phenotypic ratio wouldn't be 1:1:1:1, it
would have 2 phenotypes at a larger proportion to the other 2.

