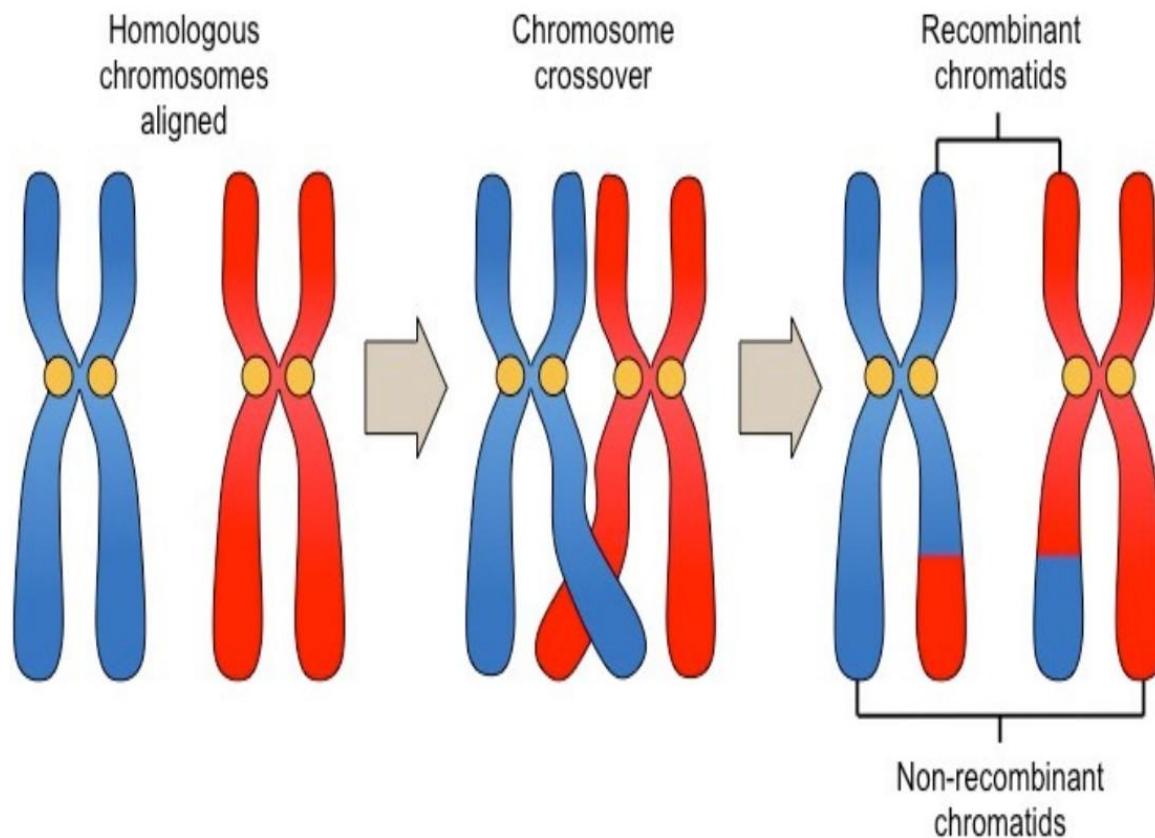
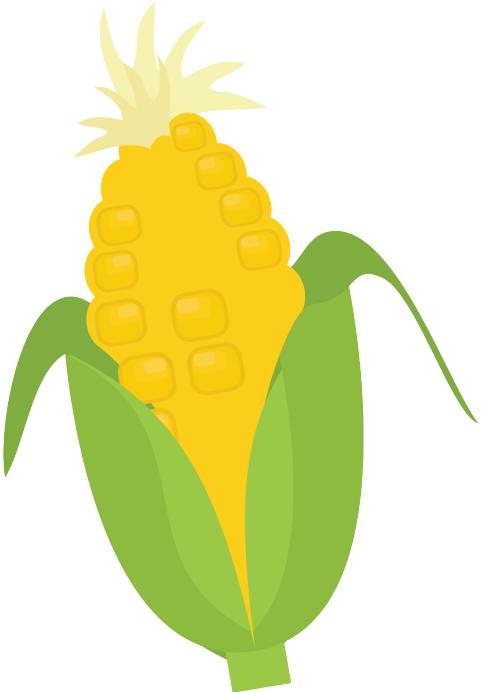


Marvel: “Infinity War is the most ambitious crossover event in history”

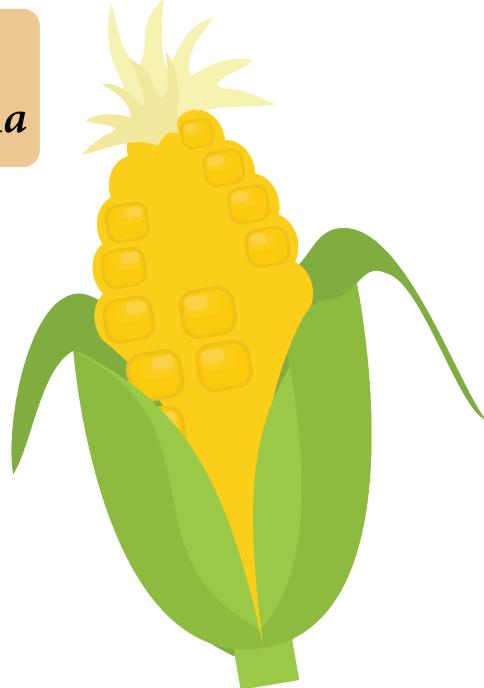
Me:



# Recombination, linkage, and the 3-point testcross



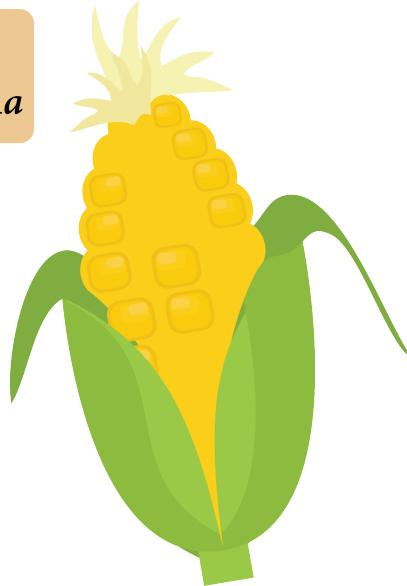
Tuft  
*AA or Aa*



No tuft  
*aa*



Tuft  
*AA or Aa*



No tuft  
*aa*




## Recombination: more ways to shuffle

Purple corn,  
Orange stem

$$\begin{array}{c} yl \quad gr \\ \hline yl \quad gr \end{array}$$



Possible pollen (sperm) genotypes

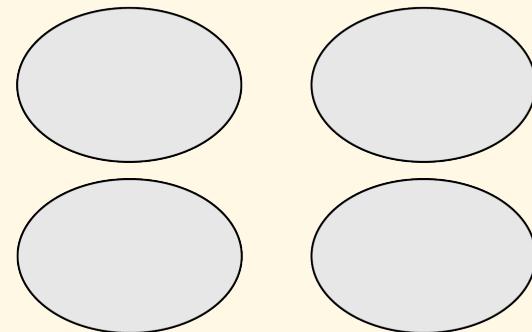
$\chi$



Yellow corn,  
Green stem

$$\begin{array}{c} Yl+ \quad Gr+ \\ \hline yl \quad gr \end{array}$$

Possible ovule (egg) genotypes



Purple corn,  
Orange stem

$$\begin{array}{c} yl \quad gr \\ \hline yl \quad gr \end{array}$$

$$\begin{array}{c} yl \quad gr \\ \hline \end{array}$$

Possible pollen (sperm) genotypes



*Parental genotypes*

$\times$



*Recombinant genotypes*

Yellow corn,  
Green stem

$$\begin{array}{c} Yl+ \quad Gr+ \\ \hline yl \quad gr \end{array}$$

Possible ovule (egg) genotypes

$$\begin{array}{c} Yl+ \quad Gr+ \\ \hline \end{array}$$

$$\begin{array}{c} \quad \quad \quad \\ \hline yl \quad gr \end{array}$$

$$\begin{array}{c} Yl+ \quad gr \\ \hline \end{array}$$

$$\begin{array}{c} \quad \quad \quad \\ \hline yl \quad Gr+ \end{array}$$

Purple corn,  
Orange stem

$$\frac{yl \quad gr}{\underline{yl \quad gr}}$$

yl    gr

Possible pollen (sperm) genotypes



$\chi$



Yellow corn,  
Green stem

$$\frac{Yl+ \quad Gr+}{\underline{yl \quad gr}}$$

Possible ovule (egg) genotypes

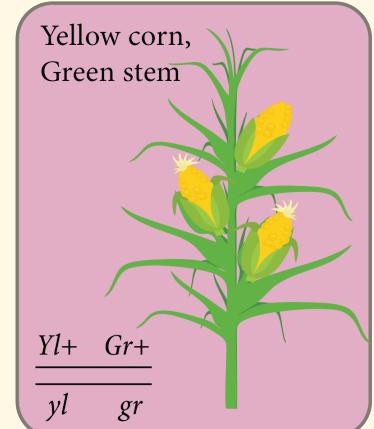
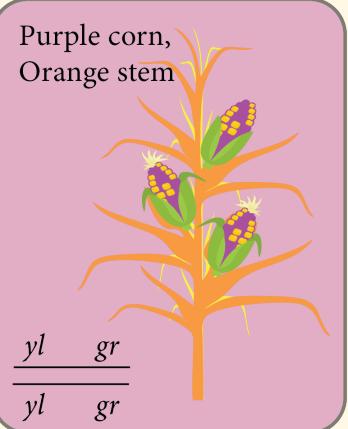
Yl+    Gr+

Yl+    gr

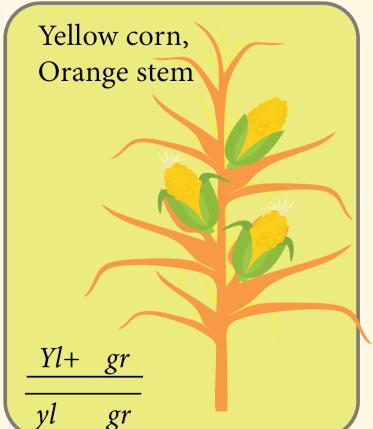
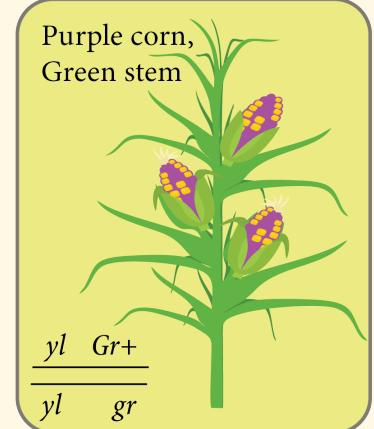
yl    gr

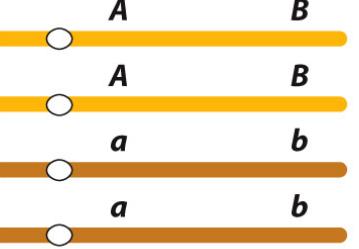
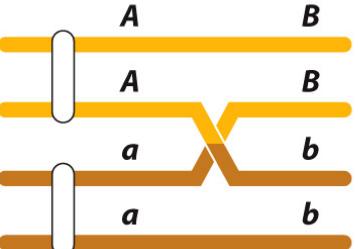
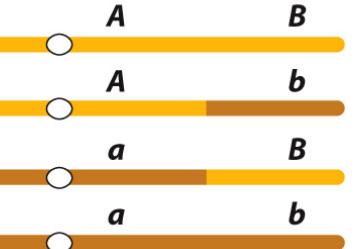
yl    Gr+

## Parental genotypes



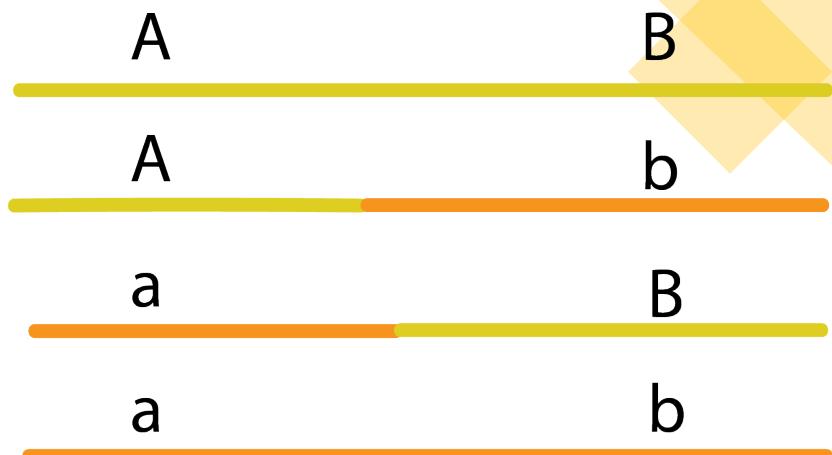
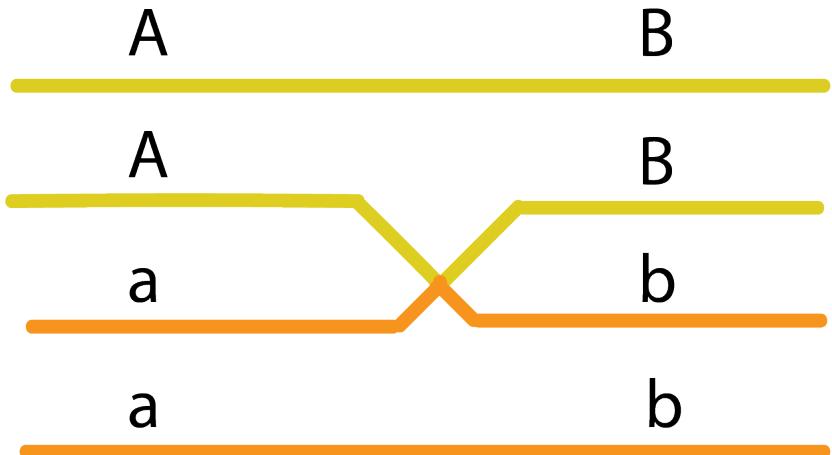
## Recombinant genotypes

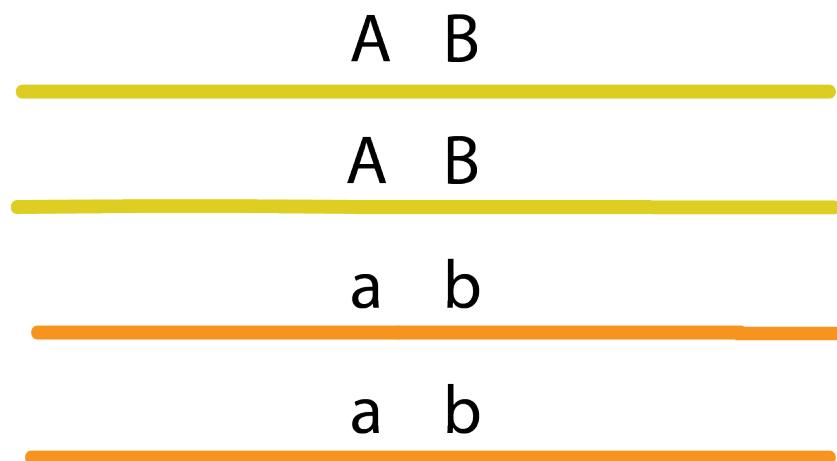
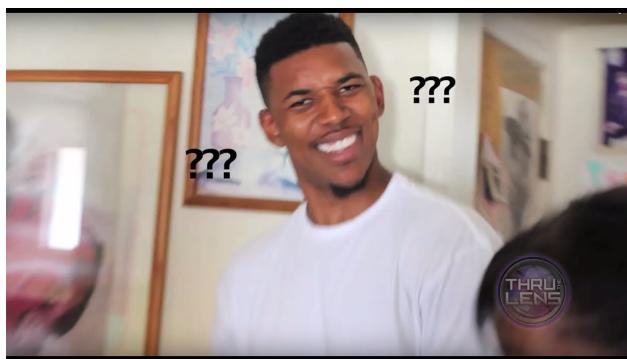


	<b>Meiotic chromosomes</b>	<b>Meiotic products</b>	
<b>Meioses with no crossover between the genes</b>			Parental Parental Parental Parental
<b>Meioses with a crossover between the genes</b>			Parental Recombinant Recombinant Parental

**Figure 4-7**

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Purple corn,  
Orange stem

$$\frac{yl \quad gr}{\underline{yl \quad gr}}$$

$$\underline{\underline{yl \quad gr}}$$

Possible pollen (sperm) genotypes



$\times$



Yellow corn,  
Green stem

$$\frac{Yl+ \quad Gr+}{\underline{yl \quad gr}}$$

Possible ovule (egg) genotypes

$$\underline{\underline{Yl+ \quad Gr+}}$$

$$\underline{\underline{Yl+ \quad gr}}$$

$$\underline{\underline{yl \quad gr}}$$

$$\underline{\underline{yl \quad Gr+}}$$

## Parental genotypes

Purple corn,  
Orange stem

$$\frac{yl \quad gr}{\underline{yl \quad gr}}$$

Yellow corn,  
Green stem

$$\frac{Yl+ \quad Gr+}{\underline{yl \quad gr}}$$

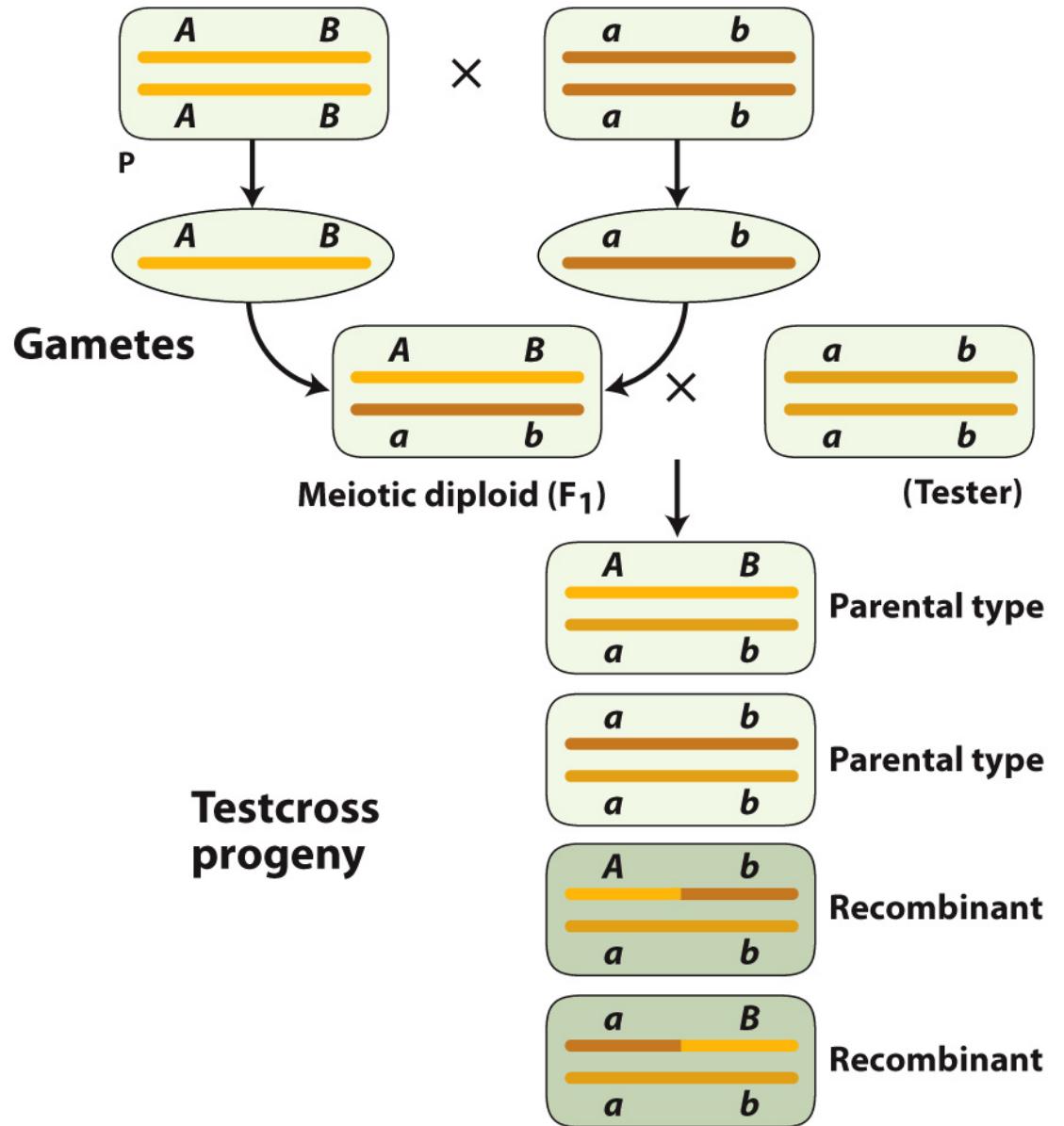
## Recombinant genotypes

Purple corn,  
Green stem

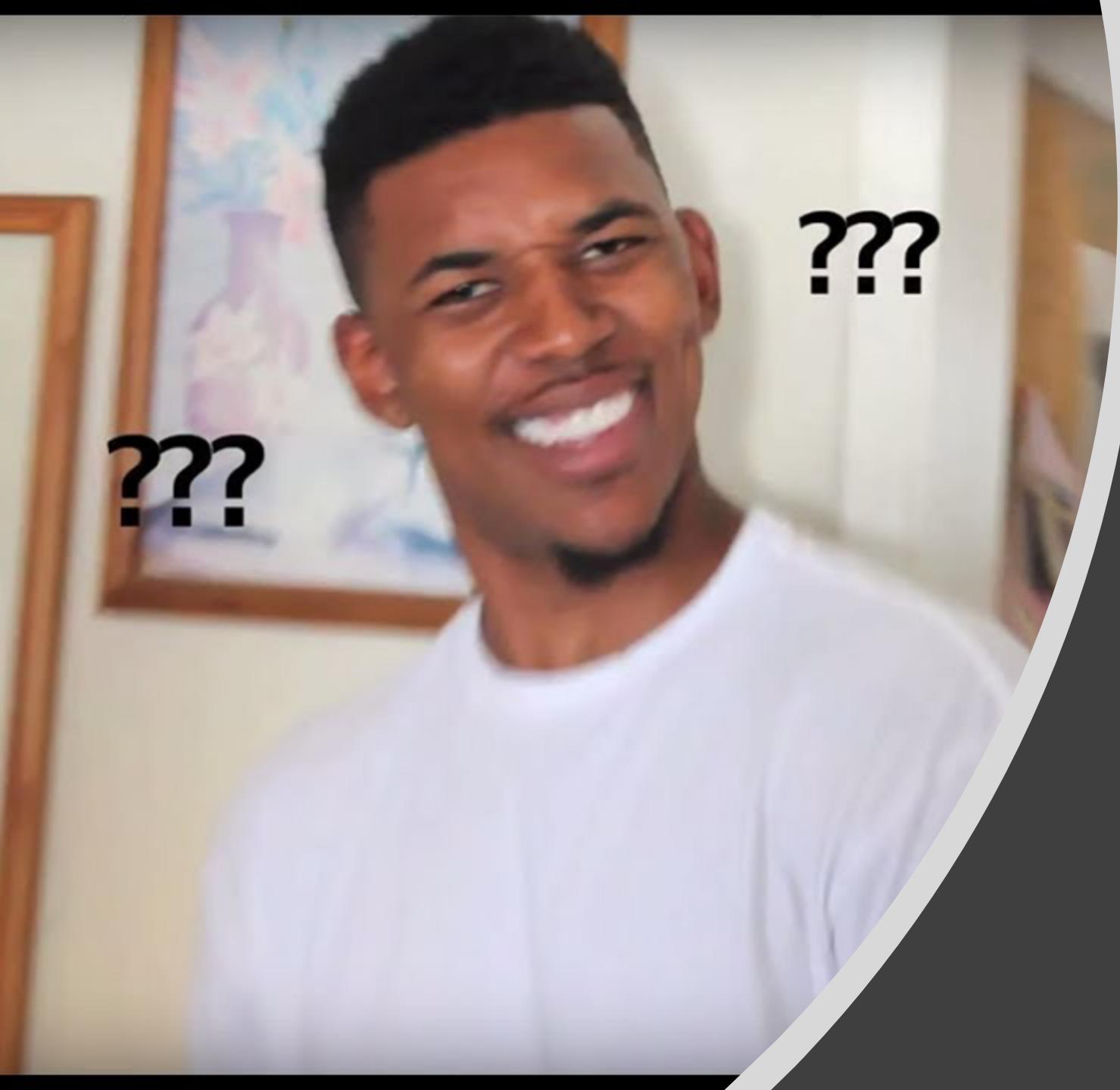
$$\frac{yl \quad Gr+}{\underline{yl \quad gr}}$$

Yellow corn,  
Orange stem

$$\frac{Yl+ \quad gr}{\underline{yl \quad gr}}$$



**Figure 4-8**  
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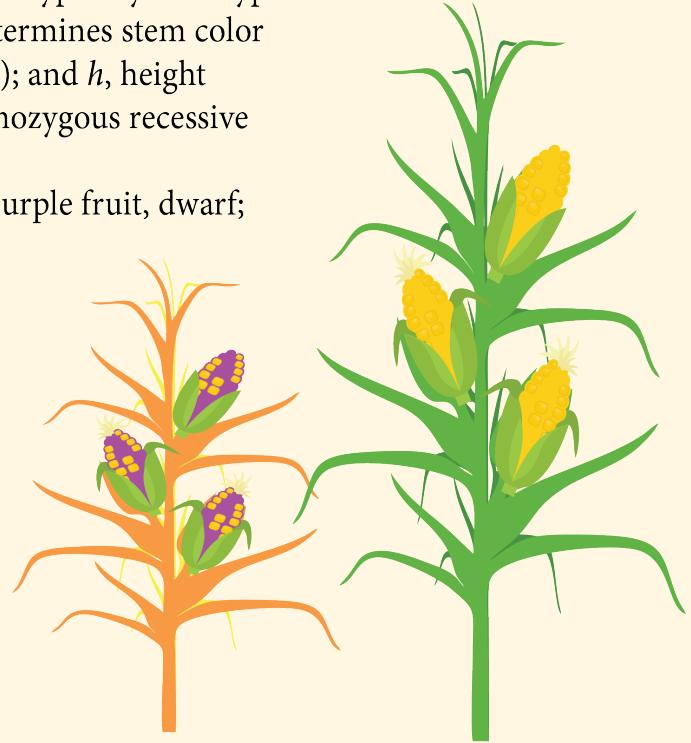


Three linked  
genes?

R. A. Emerson crossed two different pure-breeding lines of corn and obtained a phenotypically wild-type F1 that was heterozygous for three alleles that determine recessive phenotypes: *st* determines stem color (recessive orange, wild-type green); *fr*, fruit color (recessive purple, wild-type yellow); and *h*, height (recessive dwarf, wild-type normal). He testcrossed the F1 with a tester that was homozygous recessive for the three genes and obtained these progeny phenotypes:

355 orange stem; 339 purple fruit, dwarf; 88 completely wild-type; 55 orange stem, purple fruit, dwarf; 21 dwarf; 17 orange stem, purple fruit; 2 purple fruit; 2 orange stem, dwarf.

<i>Number</i>	<i>Gametes</i>		



*Parental genotypes:*

--	--

*Determine gene order:*

--

# The Steps

1. Find the phenotypes that have the highest number of offspring: these are your parental classes!
2. Find the phenotypes with the fewest number of offspring: these are your double crossovers!
3. Determine gene order by comparing these two classes
4. Re-write all genotypes in descending order with proper gene orientation
5. Make your columns and evaluate genes pairwise
6. Count totals from each class (parental, SCO, DCO)
7. Divide by TOTAL number of progeny for % recombinants
8. Remember: % recombinants == map units!