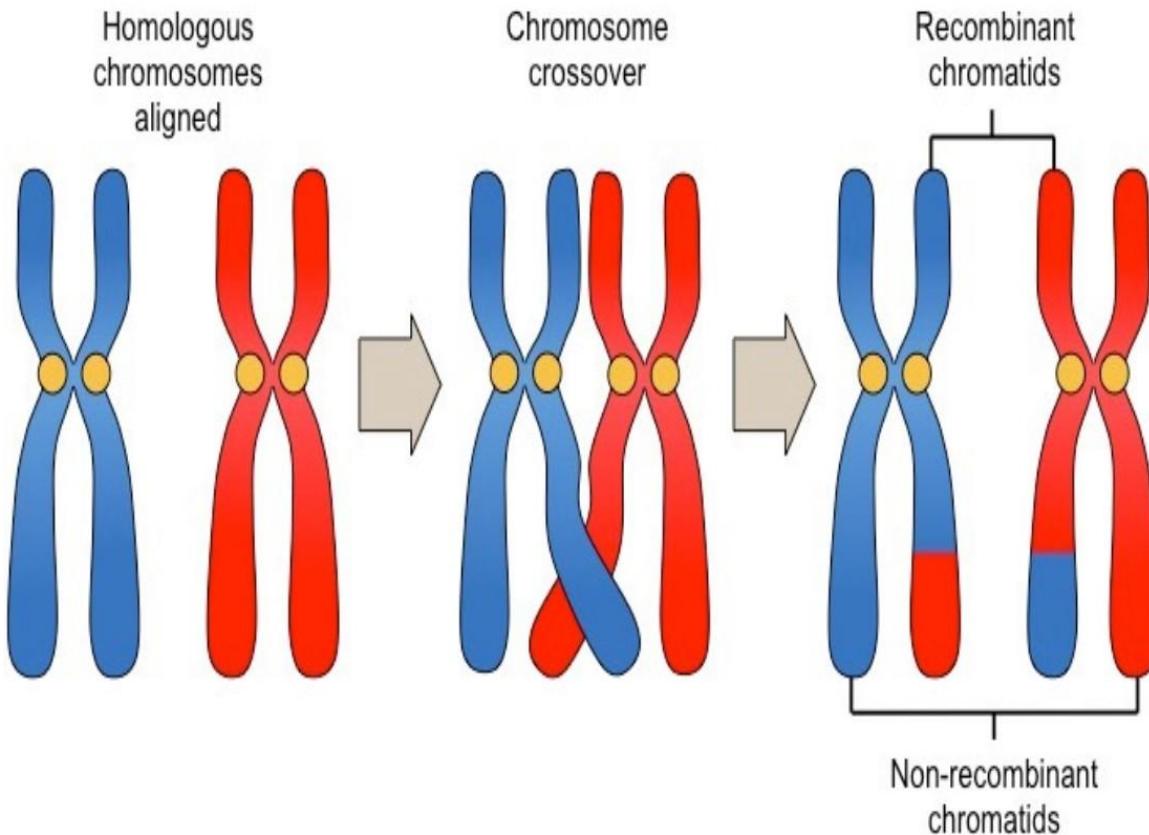


Marvel: “Infinity War is the most ambitious crossover event in history”

Me:



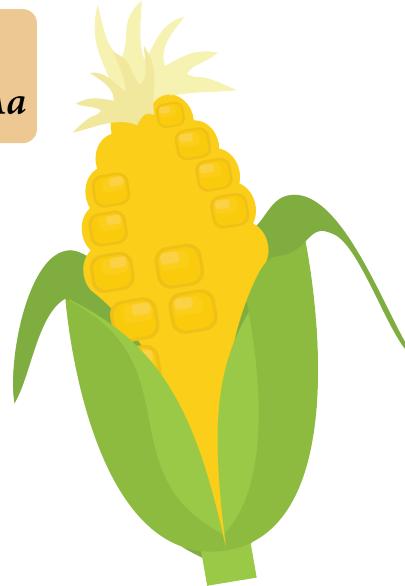
Recombination, linkage, and the 3-point testcross



Independent assortment:
It's all coin flips!

X locus

Tuft
 AA or Aa



No tuft
 aa



a

A a

A	a
a	

Recombination: more ways to shuffle

Purple corn,
Orange stem

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

"fester"

$$yl \quad gr$$

Possible pollen (sperm) genotypes



\times



Yellow corn,
Green stem

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

Possible ovule (egg) genotypes

$$Yl^+ Gr^+$$

$$Yl^+ gr$$

$$yl \quad gr$$

$$yl \quad Gr^+$$

Purple corn,
Orange stem

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

$$yl \quad gr$$

Possible pollen (sperm) genotypes



\times



Yellow corn,
Green stem

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

Possible ovule (egg) genotypes

$$Yl+ \quad Gr+$$

$$Yl+ \quad gr$$

$$yl \quad gr$$

$$yl \quad Gr+$$

Parental genotypes

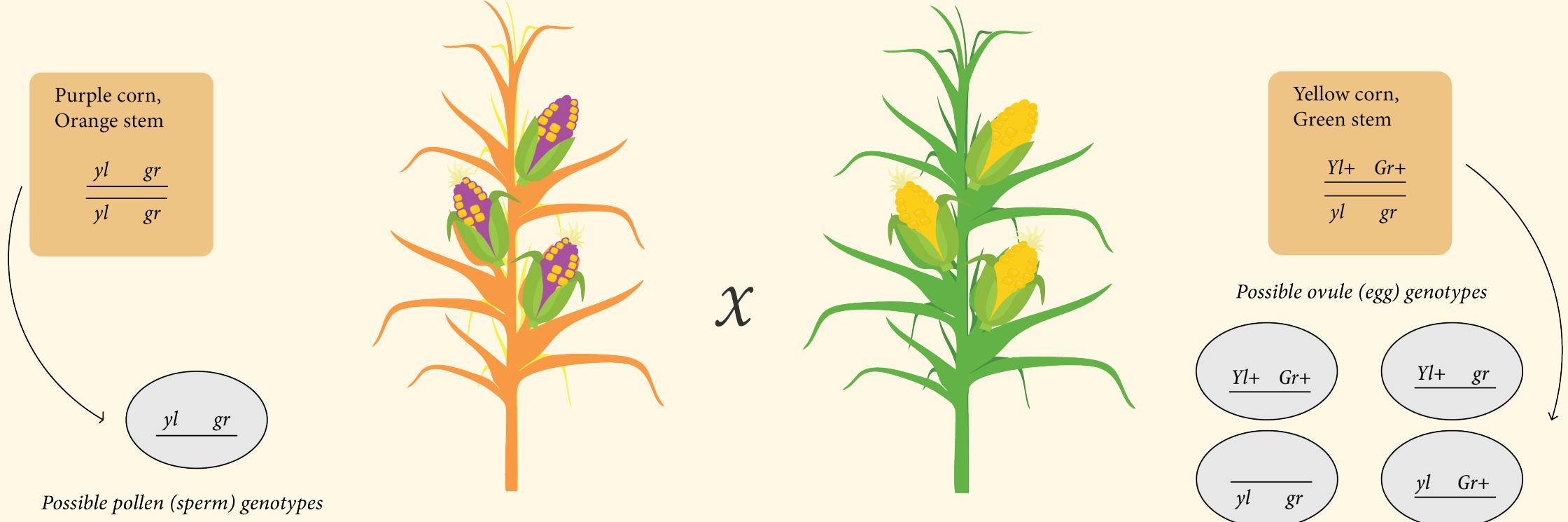
$$Yl \quad gr$$

$$Yl \quad gr$$

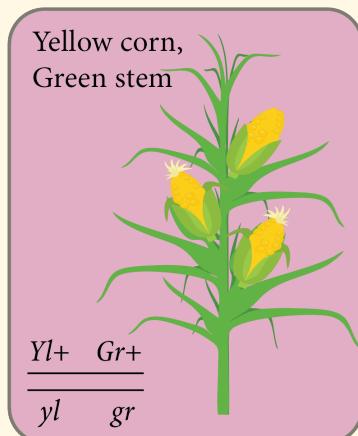
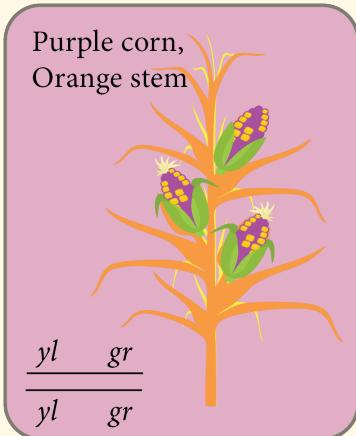
Recombinant genotypes

$$Yl \quad gr$$

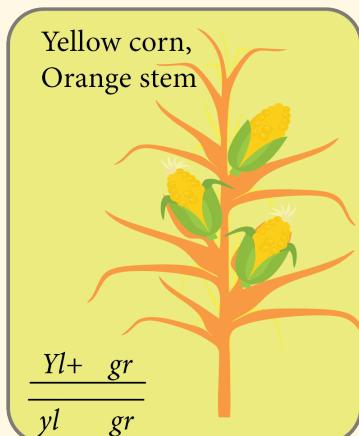
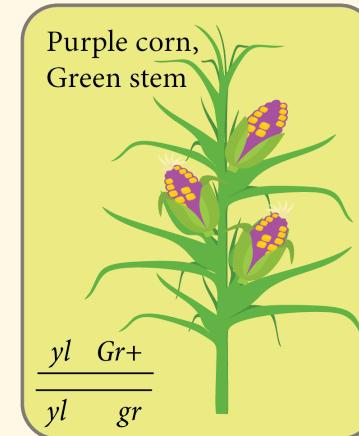
$$Yl \quad gr$$



Parental genotypes



Recombinant genotypes



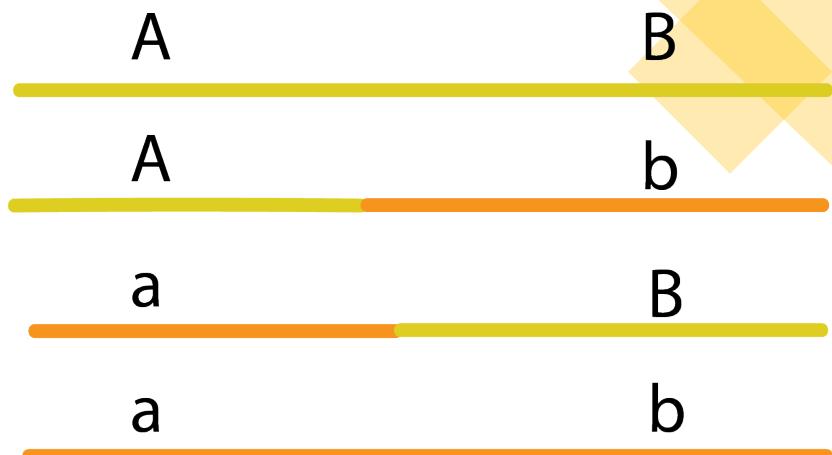
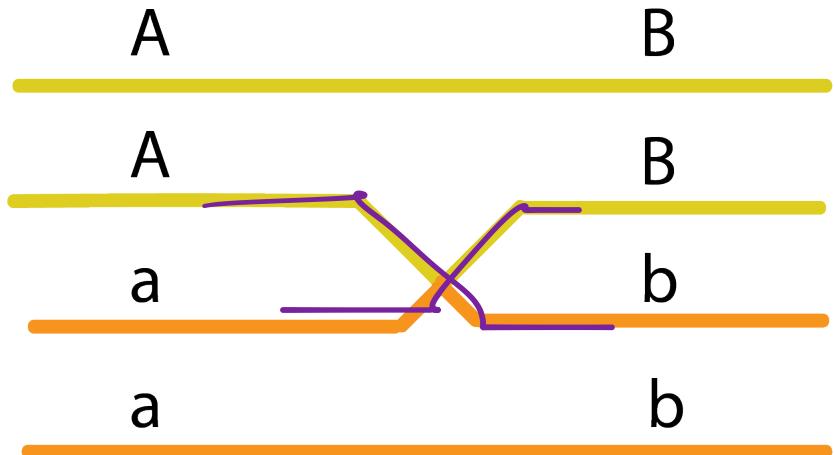
	Meiotic chromosomes	Meiotic products	
Meioses with no crossover between the genes			Parental Parental Parental Parental
Meioses with a crossover between the genes			Parental Recombinant Recombinant Parental

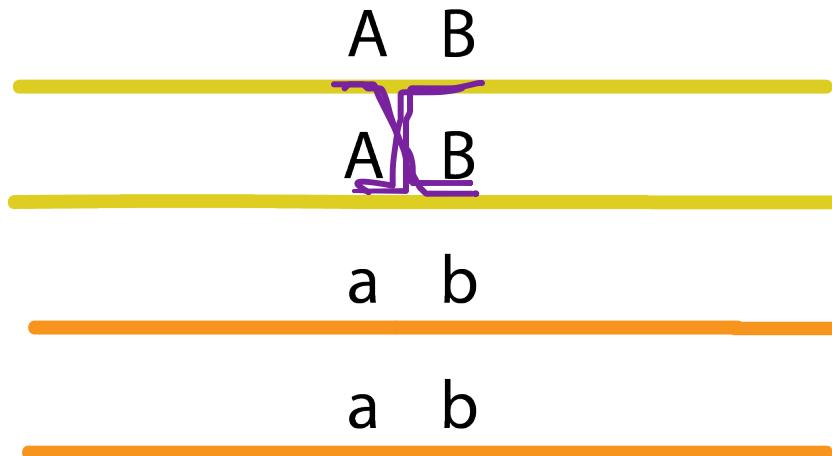
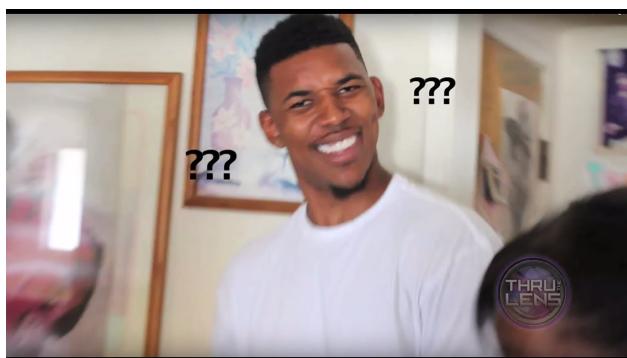
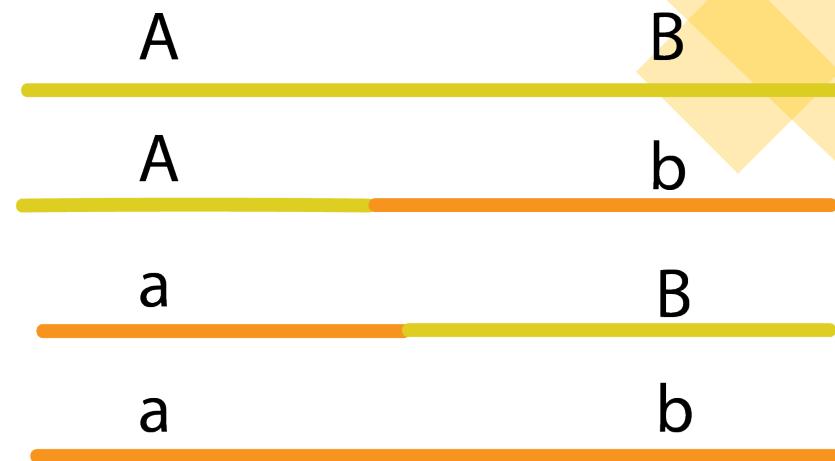
Figure 4-7
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It's all coin flips!
 Well, except.....

→ 50%
] 50%
 = 100%





→ linked =
fewer than 50%
recombinants

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



\times



Yellow corn,
Green stem

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

Possible ovule (egg) genotypes

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

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

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

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



OH NO!!!
My original arithmetic was wrong — see
how I fixed it below!

Parental genotypes

Purple corn,
Orange stem

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

240

Yellow corn,
Green stem

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

254

Recombinant genotypes

Purple corn,
Green stem

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

100 50

Yellow corn,
Orange stem

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

106 56

$$240 + 254 = 494$$

$$494 / 600 = 82\%$$

$$50 + 56 = \underline{\underline{106}}$$

$$106 / 600 = 18\%$$

gr 18 mu yr

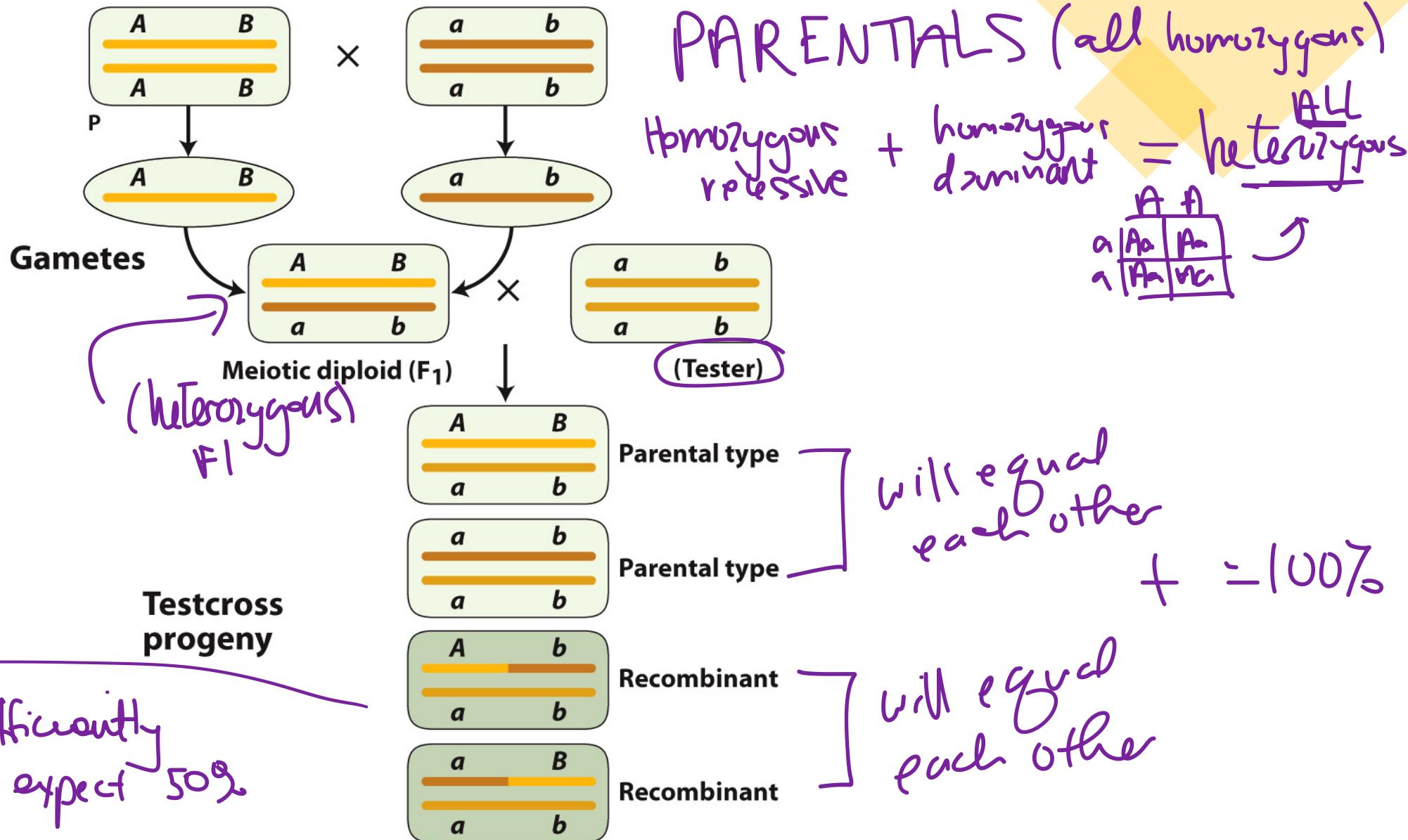
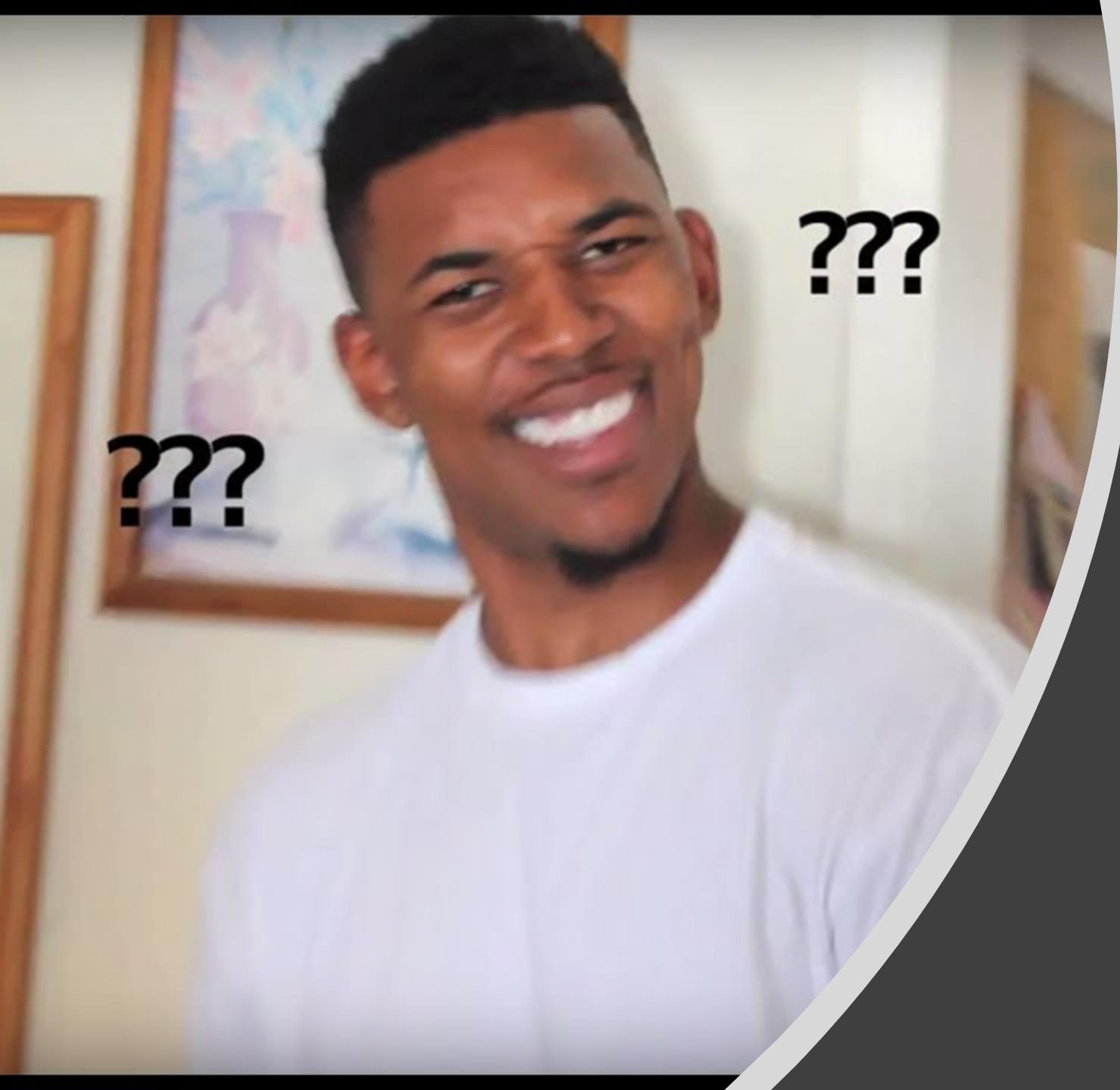


Figure 4-8

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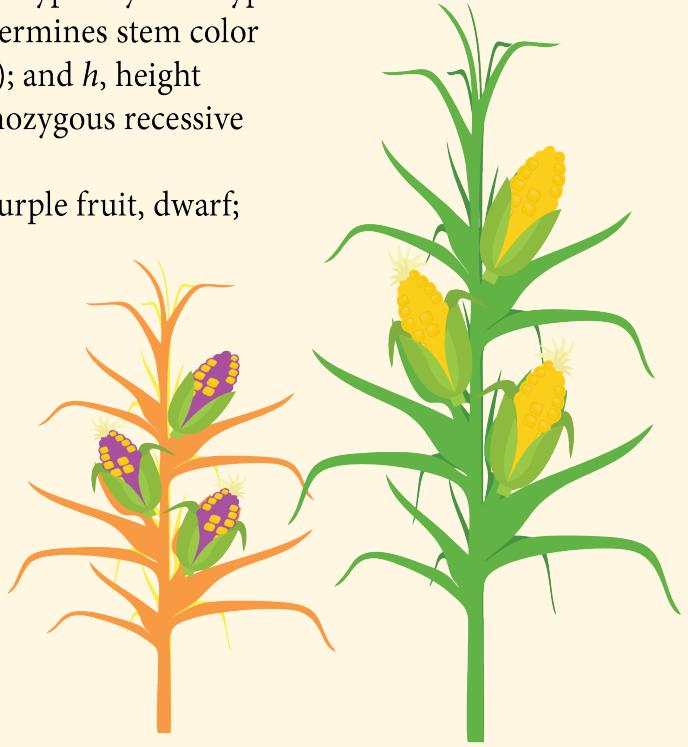


Three linked
genes?

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>	<i>st - h</i>	<i>h - fr</i>
parental	[355	<i>st + +</i>		
	339	+ <i>h Fr</i>		
SCW	[88	+ + +	R	
	55	<i>st h Fr</i>	R	
SCW	[21	+ <i>h +</i>	R	
	17	<i>st + Fr</i>	R	
DCO	[2	+ + <i>fr</i>	R	R
	2	<i>st h +</i>	R	R
	879		$147/879 = 0.167 = 16.7\%$	$12/879 = 0.013 = 1.3\%$

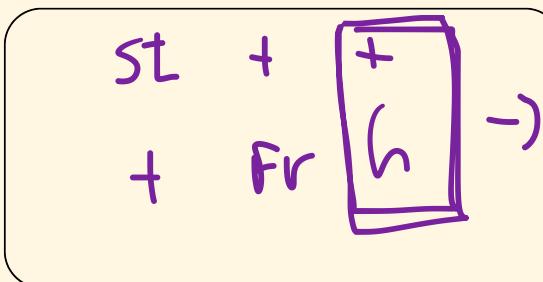


Parental genotypes:

sc h fr /
st h fr

st + + /
+ h fr

Determine gene order:



The Steps

1. Find the phenotypes that have the highest number of offspring → *parental!*
2. Determine gene order → *Compare DGs*
3. Re-write in descending order with proper gene orientation → *make life easier!*
4. Make your columns and evaluate genes pairwise → *compute*
5. Count totals from each class (parental, SCO, DCO)
6. Divide by TOTAL number of progeny for % recombinants
7. Remember: % recombinants == map units!

(P)