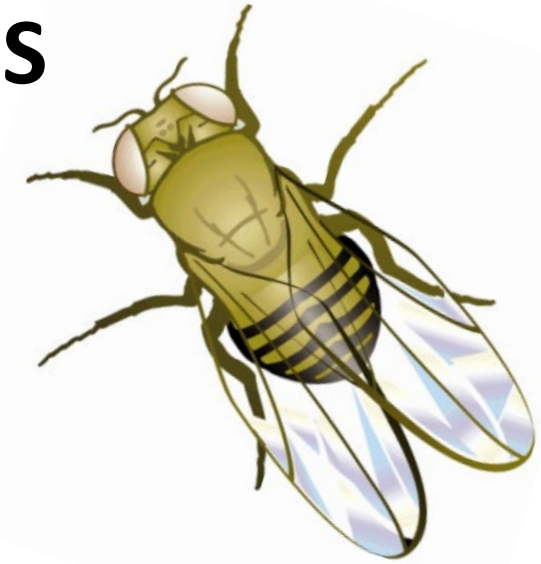
UNIT 4 | LINKAGE MAPS



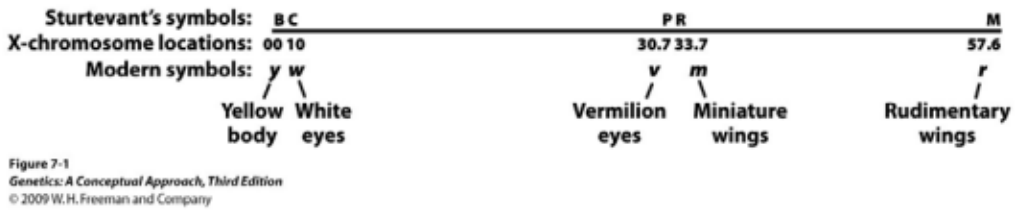


Figure 7-1
Genetics: A Conceptual Approach, Third Edition

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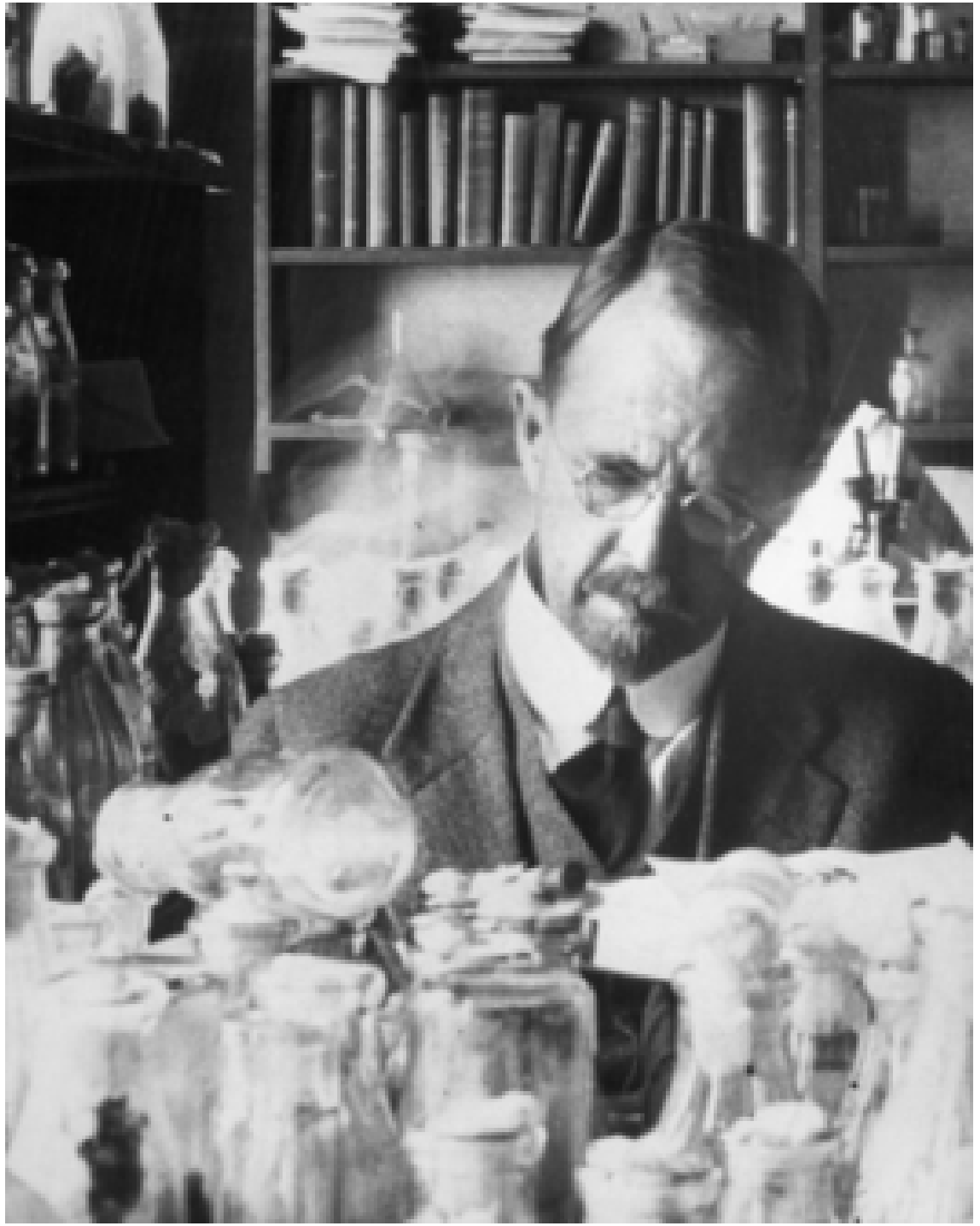
UNIVERSIDAD DE GRANADA



CHROMOSOME TEORY OF INHERITANCE (SUTTON & BOVERI THEORY)

- **Genes** are physically located in chromosomes (locus/loci).
- Chromosomes in **meiosis** explain the Mendel's observations.
- Genes in the same chromosome **do not segregate independently** (linkage)

White mutation (X-linked) in Drosophila described by Morgan was crucial to demonstrated this theory

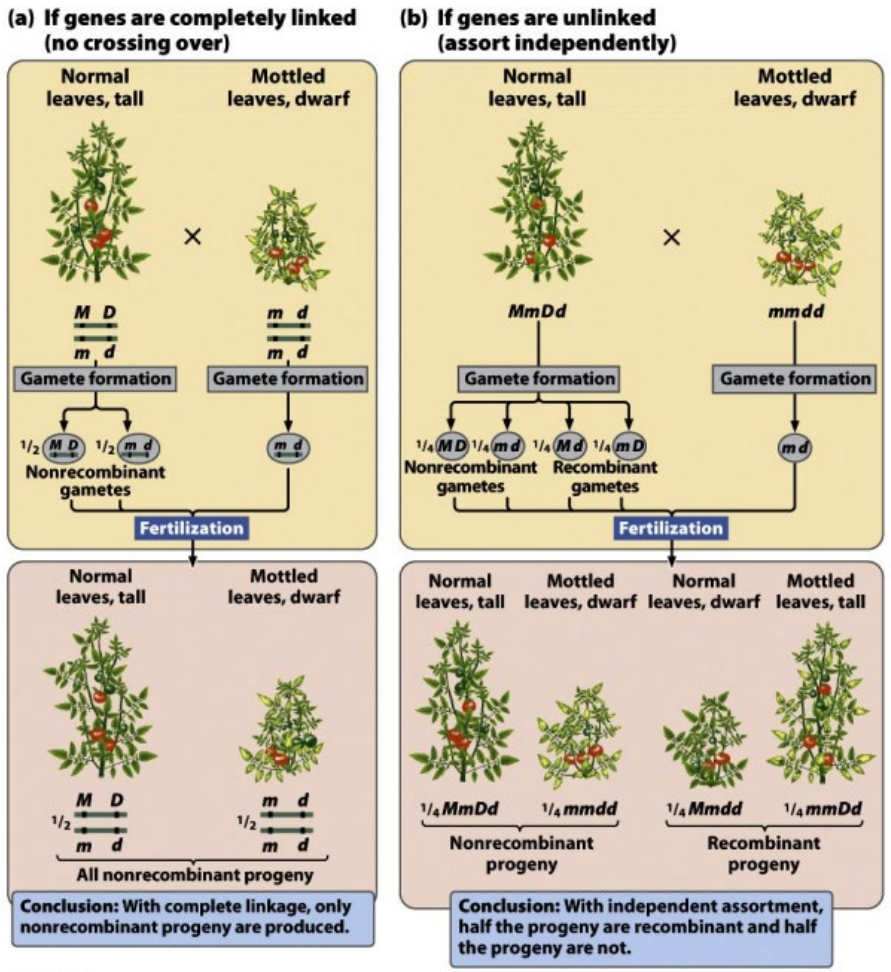
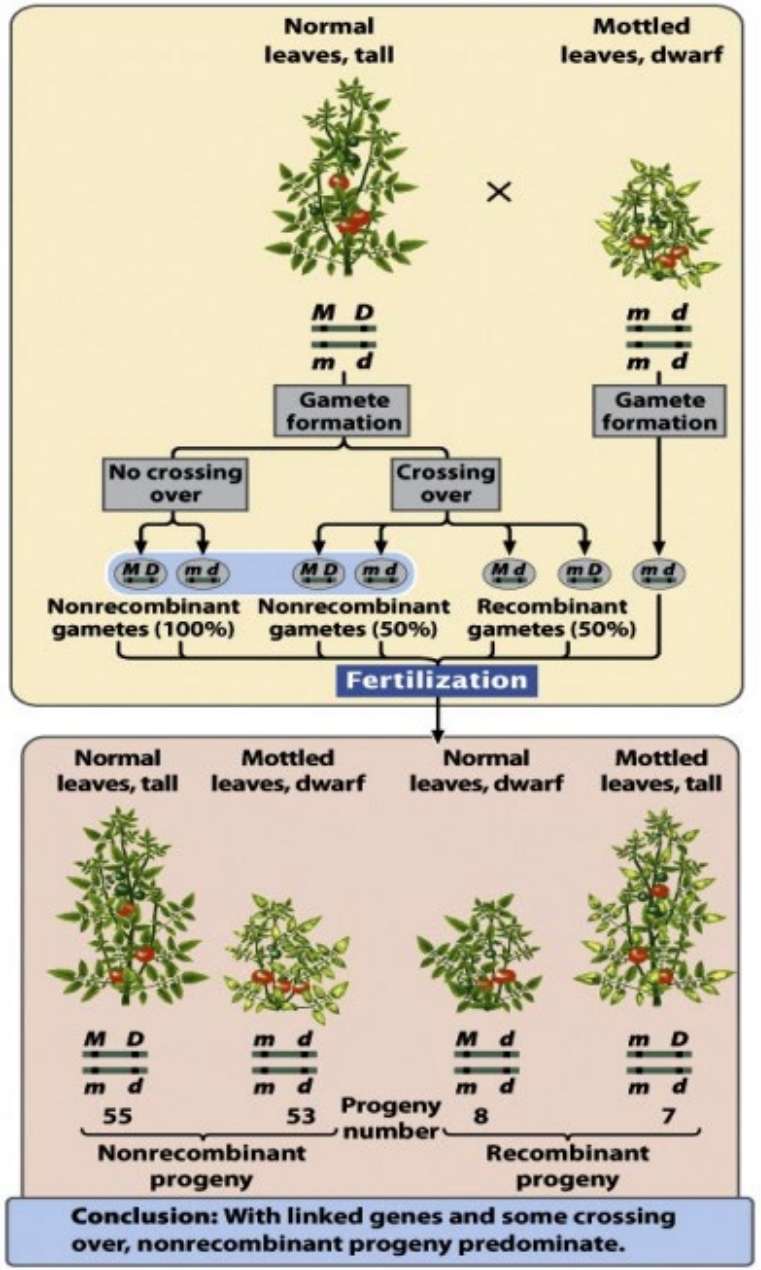


Figure 7-5
Genetics: A Conceptual Approach, Third Edition

COMPLETE LINKAGE

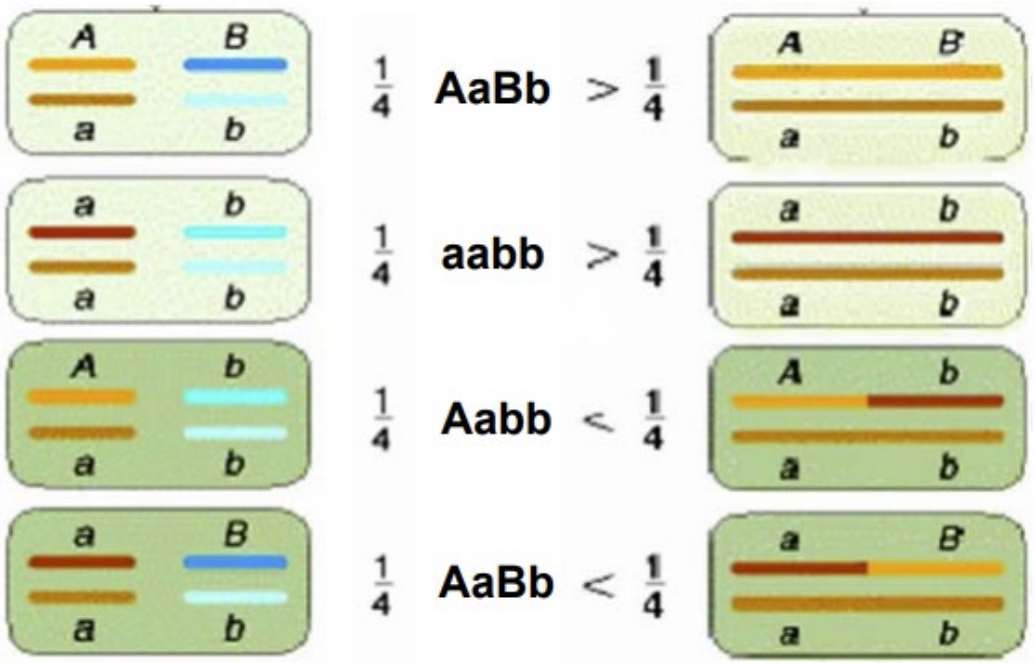
VS

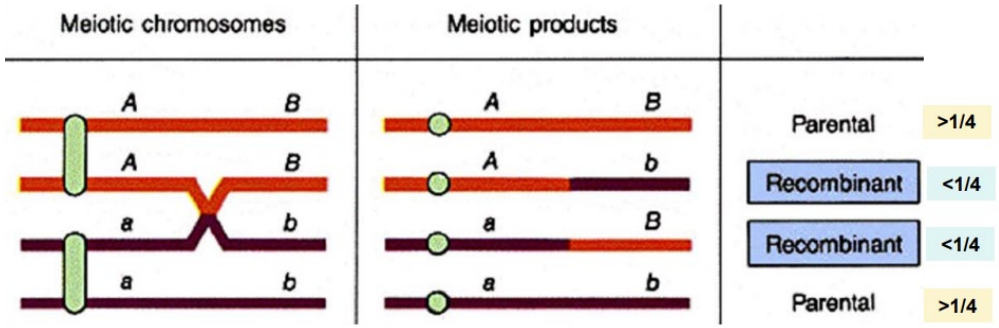
INCOMPLETE LINKAGE



AaBb x aabb

NON-LINKED GENES **LINKED GENES**





50% OF NEW COMBINATIONS

<50% OF NEW COMBINATIONS (recombinants)

TWO-POINT MAPS

++ ++ x prpr vgvg — **P**

↓

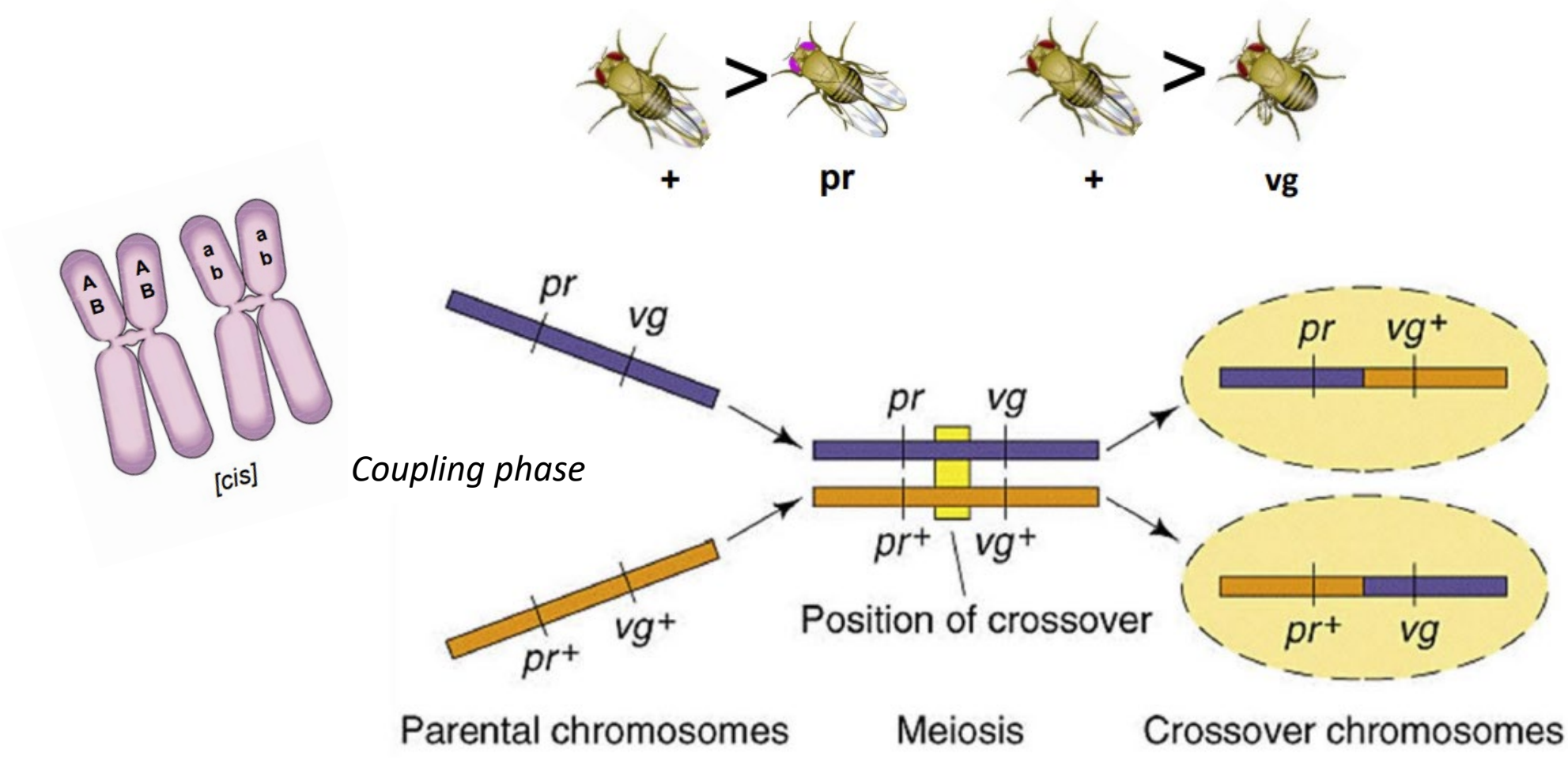
+pr +vg x prpr vgvg — **F1**

↓

F2

	Expected	Observed
+pr+vg	709 (1)	1338
prpr vgvg	709 (1)	1195
+pr vgvg	709 (1)	151
prpr +vg	709 (1)	152
	2836	**2836**

TWO-POINT MAPS



TWO-POINT MAPS

++ vgvg x prpr ++ **P**

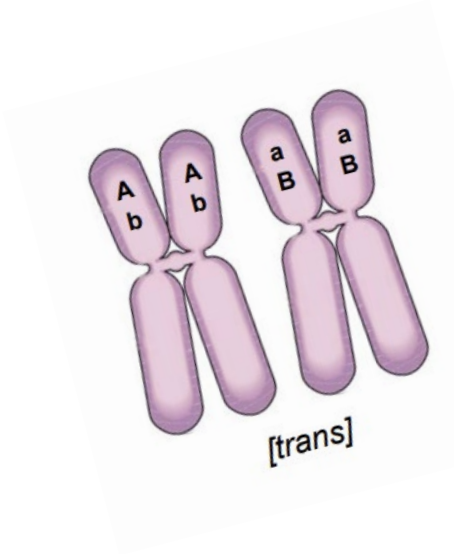
↓

+pr +vg x prpr vgvg **F1**

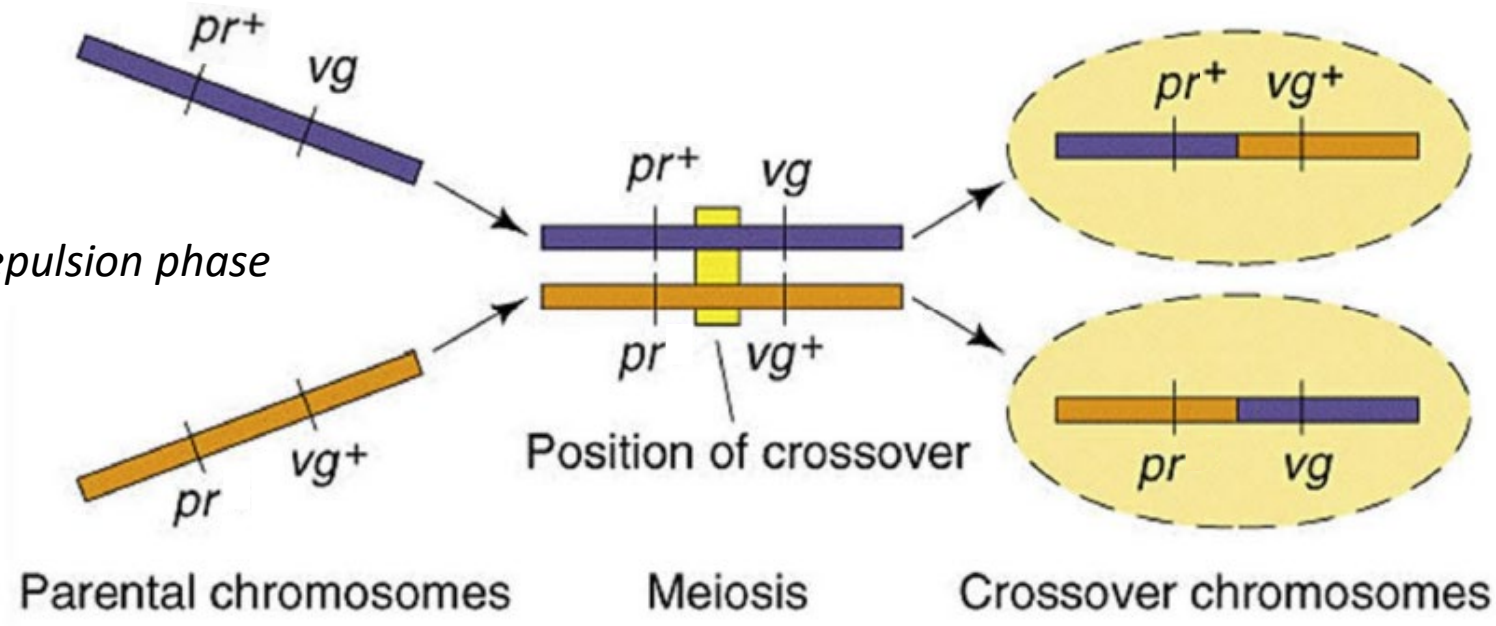
↓

	Expected	Observed	
			F2
+pr+vg	583 (1)	156	
prpr vgvg	583 (1)	146	
+pr vgvg	583 (1)	965	
prpr +vg	583 (1)	1065	
	2332	**2332**	

TWO-POINT MAPS



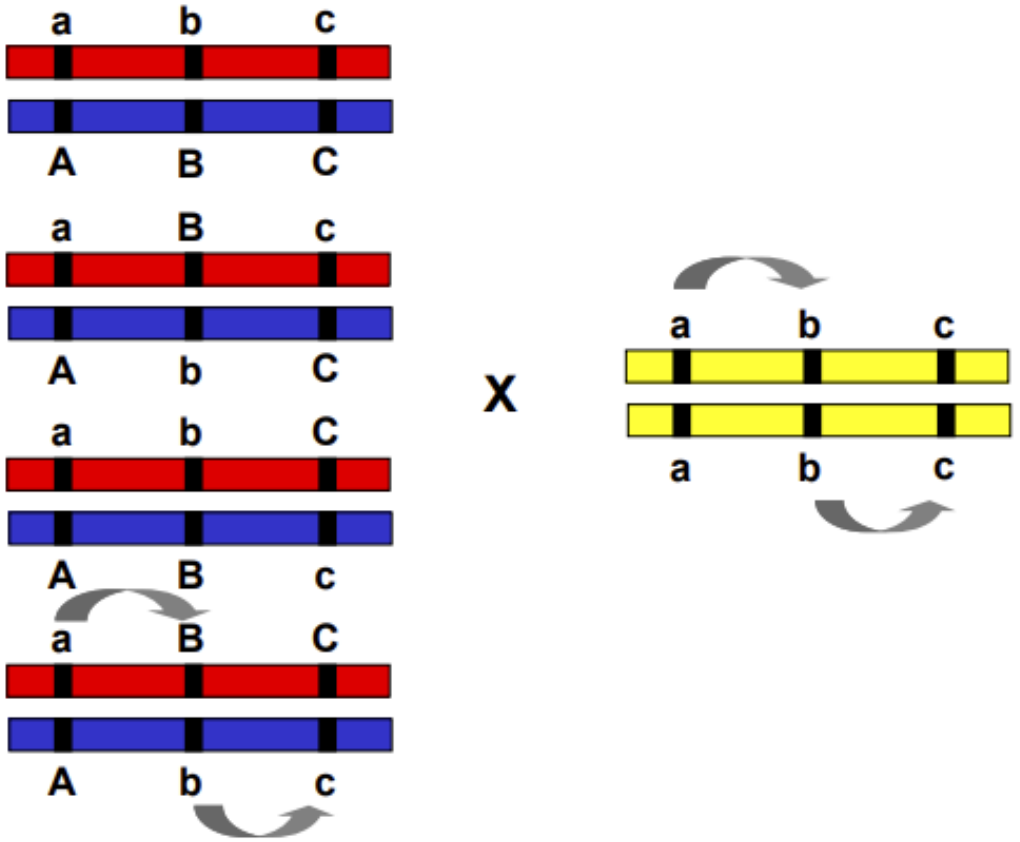
Repulsion phase



THREE-POINT MAPS

AaBbCc x aabbcc

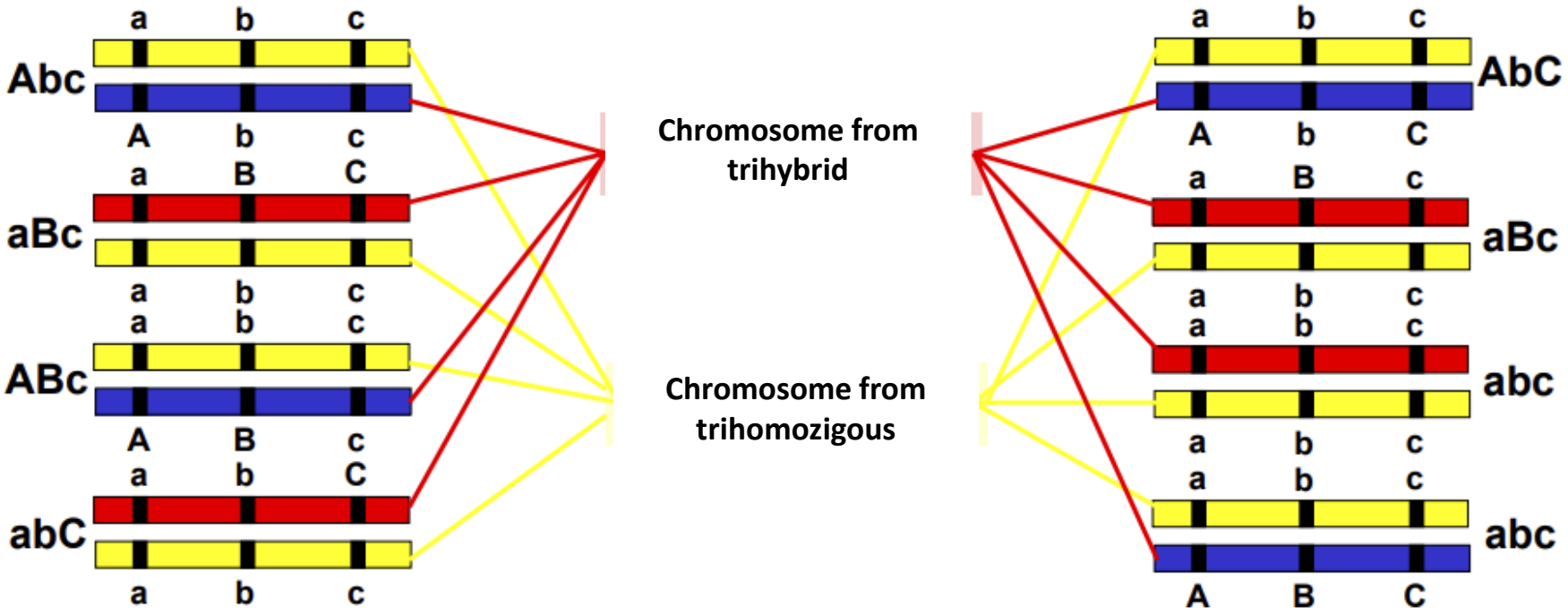
Trihybrid Test Cross



THREE-POINT MAPS

PHENOTYPES	NUMBER OF INDIVIDUALS
Abc	230
aBC	237
ABc	82
abC	79
AbC	200
aBc	195
abc	44
ABC	42

THREE-POINT MAPS

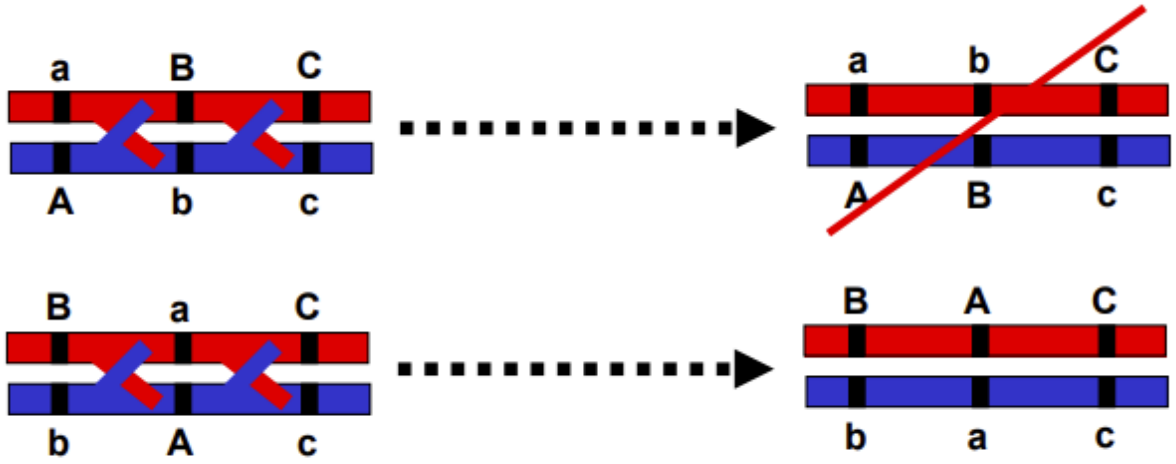


THREE-POINT MAPS

Abc	230		PARENTAL
aBC	237	**42.1%**	
ABc	82		SINGLE RECOMBINANTS
abC	79	**14.5%**	
AbC	200		
aBc	195	**35.6%**	
abc	44		DOUBLE RECOMBINANTS
ABC	42	**7.8%**	

THREE-POINT MAPS

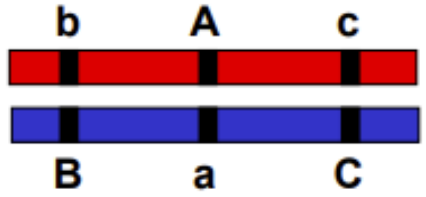
Positioning the central marker



abc **ABC**	44 42	**7.8%**

DOUBLE RECOMBINANTS

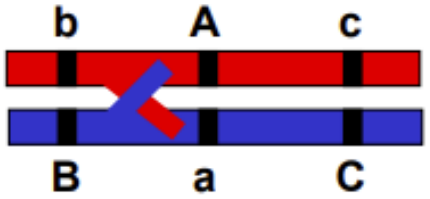
THREE-POINT MAPS



Abc **aBC**	230 237	**42.1%**
ABc **abC**	82 79	**14.5%**
AbC **aBc**	200 195	**35.6%**
abc **ABC**	44 42	**7.8%**

PARENTAL

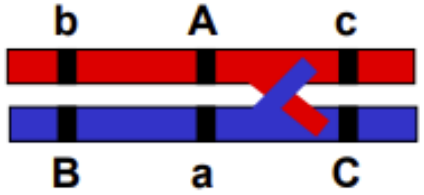
THREE-POINT MAPS



Abc **aBC**	230 237	**42.1%**
ABc **abC**	82 79	**14.5%**
AbC **aBc**	200 195	**35.6%**
abc **ABC**	44 42	**7.8%**

SINGLE RECOMBINANTS

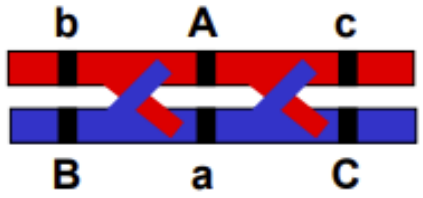
THREE-POINT MAPS



Abc	230	
aBC	237	**42.1%**
ABc	82	
abC	79	**14.5%**
AbC	200	
aBc	195	**35.6%**
abc	44	
ABC	42	**7.8%**

SINGLE RECOMBINANTS

THREE-POINT MAPS



Abc	230	
aBC	237	**42.1%**
ABc	82	
abC	79	**14.5%**
AbC	200	
aBc	195	**35.6%**
abc	44	
ABC	42	**7.8%**

DOUBLE RECOMBINANTS

THREE-POINT MAPS

Abc	230	467
aBC	237	**42.1%**
ABc	82	161
abC	79	**14.5%**
AbC	200	395
aBc	195	**35.6%**
abc	44	86
ABC	42	**7.8%**

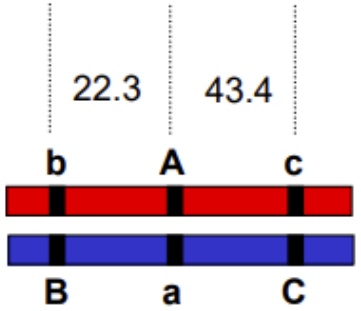
PARENTAL

SINGLE RECOMBINANTS

DOUBLE RECOMBINANTS

$$FR_{b\text{-}a} = \frac{161 + 86}{1109} \times 100 = 22.3\%$$

$$FR_{a\text{-}c} = \frac{395 + 86}{1109} \times 100 = 43.4\%$$



THREE-POINT MAPS

Interference (I): an estimation of the Independence of crossovers (in other words, the fact that a first crossover can inhibit or promote a second crossover).

https://www.nature.com/scitable/topicpage/thomas-hunt-morgan-genetic-recombination-and-gene-496/

$$I = 1 - CC$$

Coefficient of coincidence (CC): ration between observed and expected double recombinants

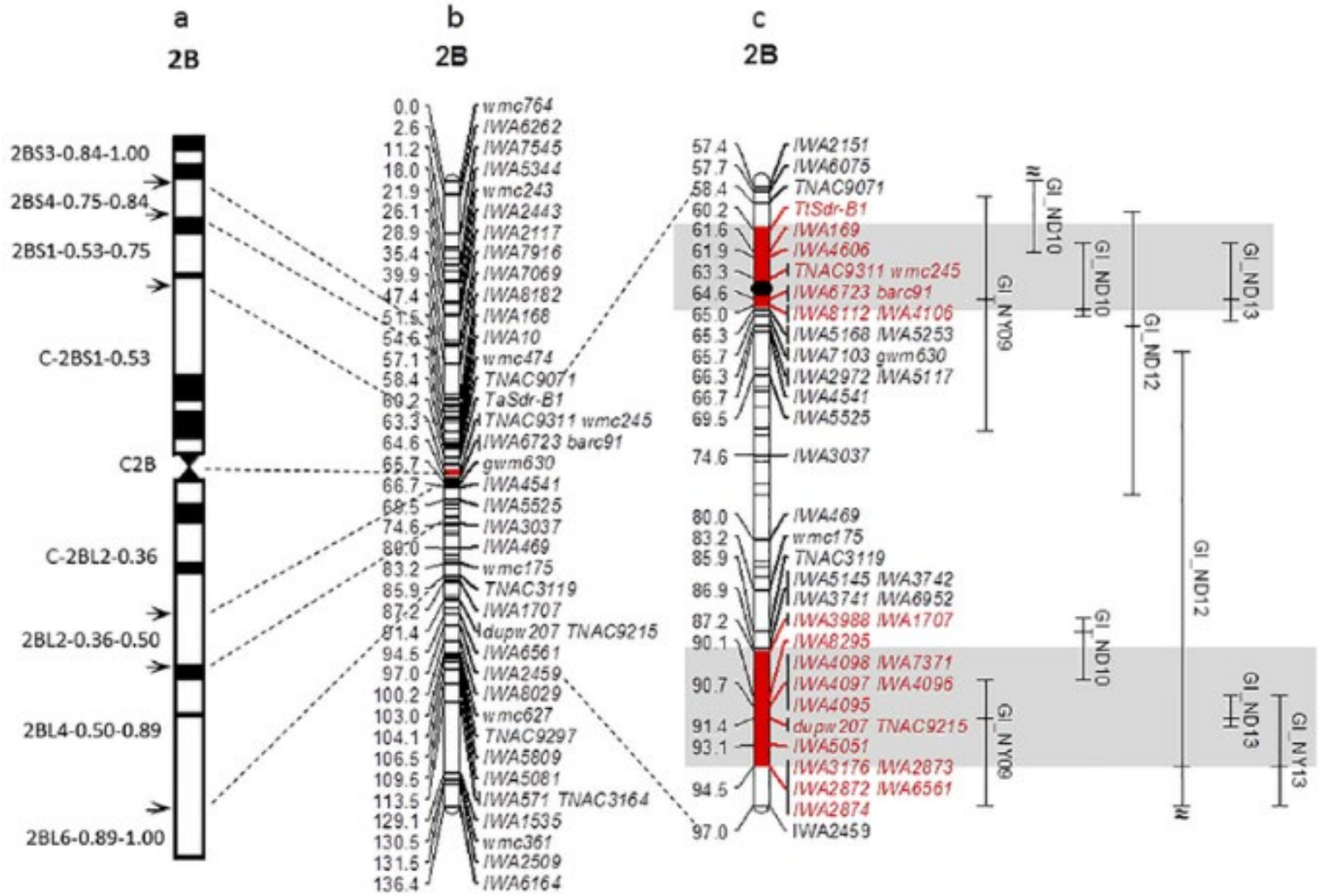
$$\frac{\text{double recombinants observed}}{\text{double recombinants expected}}$$

THREE-POINT MAPS

Complete Interference: CC = 0 and I = 1. No double recombinants observed.

CC >1: a crossover promotes the occurrence of a second crossover. I < 0.

GENETIC/LINKAGE MAP



Source: ResearGate (Mark E. Sorrells)