Chapter 17 – Sex Chromosomes, Linkage, & Organelles

I. Sex-Linked Genes

A. Sex chromosomes have small areas of homology (same genes) at their tips

B. X-Chromosome

1. Has over 1000 genes, Y has 50
2. X chromosome genes are "x-linked"
3. Males only pass X-linked genes onto their **daughters**
4. Males only need one copy of an X-linked recessive to show the recessive phenotype
   - **a.** *I.e.* If a male has one X-chromosome with the recessive allele for color blindness, there is no "normal" other X-chromosome containing the dominant allele for normal vision. In a female, the other X chromosome would "block" the one with the recessive allele.
   - **b.** Red-green color blindness is a recessive X-linked trait

C. Y Chromosome

1. The SRY gene on the Y chromosome sets the human embryo on the male development pathway
2. Only sons inherit Y-linked genes
3. Fathers pass Y-linked genes to all sons
4. Only maleness & some male fertility traits are known to follow a Y-linked pattern of inheritance

II. Linked Genes

A. Genes that are located close to each other on the same chromosome

B. Tend to be inherited as a group

C. Thomas Morgan's Fruit Fly Experiment

1. Uses different notation for dominant recessive for fruit flies

a. b^+/c^+ = dominant

b. b/c = recessive

	bc	**Phenotype**
b^+c^+	b^+c^+bc	Gray/Straight
b^+c	b^+cbc	Gray/Curved
bc^+	bc^+bc	Black/Straight
bc	bcbc	Black/Curved

Gray Body
Straight Wings

$b^+b^+c^+c^+$ x

Black Body
Curved Wings

bbcc

Gray Body
Straight Wings

$b^+ b\ c^+ c$ x

Test Cross

bbcc

Expect what from this cross (^) if genes are ***unlinked****? Punnett Square:*

Test Cross

Gray Body/Straight Wings

Expected outcome: 1:1:1:1 ratio of phenotypes

Expect what if genes are ***linked****? (Inherited together)*

$b^+ b\ c^+ c$ x bbcc

Test Cross

Gray Body/Straight Wings

	bc	**Phenotype**
b^+c^+	$b^+ c\ ^+b\ c$	Gray/Straight
bc	b c b c	Black/Curved

Expected Outcome: 1:1 ratio of phenotypes

Actual Findings from Experiment: Some new phenotypes (supports first cross, meaning genes are unlinked), but also found lots of parental phenotypes (supports second cross, meaning genes are unlinked)

III. <u>Morgan's Experiment With Linked Genes (continued)</u>

A. Morgan proposed new phenotypes are due to **<u>crossing over</u>** ***(fig. 17.10)***

1. Used this to figure out relative location of genes on a chromosome

a. Frequency of recombination is a measure of the distance between genes ***(Fig. 17.10a)***

b. Use **recombination frequencies** to estimate distance between genes

i. Map Distance between 2 linked genes = (# recombinant offspring/total # of offspring) x 100

ii. One map unit (aka centimorgans) = 1% recombination frequency

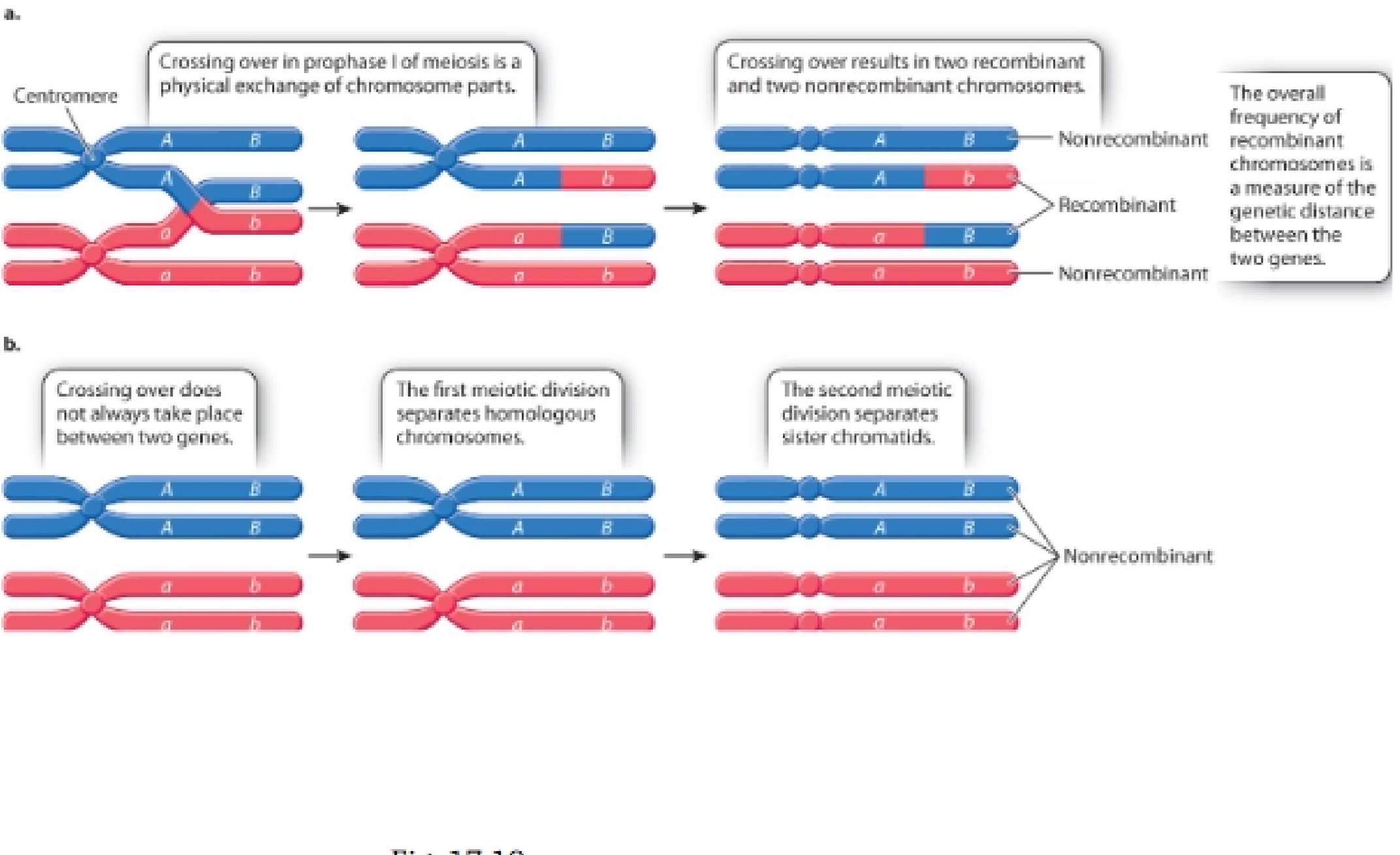

Fig. 17.10