OUTLINE 16
E. Violation of independent assortment
   3. Crossing over
   4. Chromosome mapping
   5. Effects of linkage and crossing over on genotypic and phenotypic ratios
F. Pleiotropy
G. Violation of complete expression
   1. Gene interaction - epistasis
   2. Consequences
      penetrance
      expressivity
H. Phenotypic plasticity
P: PL//PL X pl//pl

F1: (PL//pl)

= centrosome
Effects of crossing over on number of possible gamete types

With x-over

No x-over
Test cross F1 to double recessive:

Parents: PpLl X ppll
Gametes:
- PL pl: parental (7)
- Pl pl: parental (7)
- pL pL: recombinant (1)
- pl Pl: recombinant (1)

Expect 1:1:1:1 ratio of phenotypes

Bateson and Punnett observed 7:1:1:7 2/16 = 12.5% recomb.
Alfred H. “Hot Dog” Sturtevant
How do we know if it’s P-A-L, or P-L-A?

If x-over frequency between P and A is 7.5% then:

\[ \begin{array}{ccc}
P & \quad & A & \quad & L \\
\text{12.5 map units} & \quad & \text{7.5 map units} & \quad & \text{5 map units}
\end{array} \]

If x-over frequency between P and A is 17.5% then:

\[ \begin{array}{ccc}
P & \quad & L & \quad & A \\
\text{12.5 map units} & \quad & \text{5 map units} & \quad & \text{5 map units}
\end{array} \]
Fig 15.6

Recombination frequencies

- 9%
- 9.5%
- 17%

Chromosome

b

| cn |

vg
Fig 15.7

(sa (antennae mutation))

(b)

(cn)

(vg)

(be (eye color))
Application of Mendel’s Rules assumes:

1. One allele completely dominates the other

2. All genes have 2 allelic forms

3. All traits are monogenic (affected by only one locus)

4. All chromosomes occur in homologous pairs

5. All genes assort independently

6. An allele is completely expressed when either dominant or heterozygous

7. Each trait is controlled by a different set of factors
Pleiotropy:
The same locus influences coat color and crossed eyes in felines
Effect of epistasis on phenotypic ratios of a dihybrid cross

C = pigment

c = none

B = deposition of lots of pigment (black)

b = less deposition (brown)

If cc, fur is white regardless of genotype at B locus
Phenotypic plasticity in Daphnia
Crayfish predator

Sunfish predator

Snail prey
A snail raised with fish

A full sib raised with crayfish