CONCEPT: MAPPING GENES

● Measuring recombination is traditionally the best way to map gene loci on a chromosome

□ **Recombination frequencies** is the frequency of recombinant offspring produced in a cross

$$\text{Map Distance} = \frac{\text{Number of recombinant offspring}}{\text{Total number of off spring}} \text{ X } 100$$

□ Morgan's cross went like:

P: p+/p+ vg+/vg+ x p/p vg/vg

Gametes p+ vg+ p vg

F_1 p+/p vg+/vg

F_1 x tester p+/p vg+/vg x p/p vg/vg

Observed Offspring Ratios:

Genotype	Phenotype	Offspring total (2839)	Types
p+ vg+	Red, Long wing	1339	Parental
p vg	Purple, vestigial	1195	Parental
p+ vg	Red, vestigial	151	Recombinant
pr vg+	Purple, long wing	154	Recombinant

$$\frac{151+154}{2839} \text{ X } 100 = 10.7\%$$

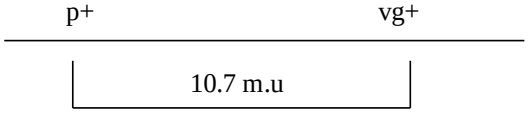
□ What is the significance of the 10.7% recombination?

- The area between the two genes is 10.7% of the length of the chromosome

- So we say these two genes are 10.7 **map units (m.u.)** apart

- Therefore, physical distance is directly correlated with recombination frequencies

- The closer two genes are, the less likely they are to cross over and recombine



□ Recombination frequencies can also determine _____ a gene is linked

- Linkage is likely **occurring** if the recombination frequencies are less than 50%

- Linkage is likely **not occurring** if the recombination frequencies are close or equal to 50%

□ Recombination frequencies are <u>never</u> greater than 50% because:

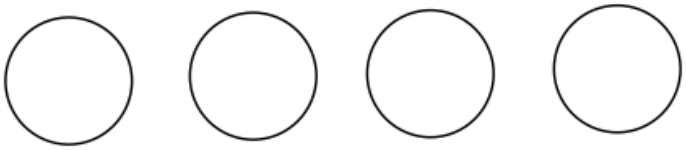
- Independent assortment equally assorts alleles, but cannot cause more than 50% recombination

EXAMPLE:

Genotype AaBb

Phenotype Yellow Round

What are the genotypes of the gametes?



<u>Modern Mapping</u>

● There are _____ types of gene loci maps

□ **Recombination maps** use recombination frequencies to determine gene loci

- Can be used to map 2+ gene loci

□ **Physical maps** use the action genomic sequence to determine gene loci

- Involves sequencing the entire chromosome, or genome of an organism

□ Mapping via certain genomic markers can also be used

- **Single Nucleotide Polymorphisms** are single nucleotide changes that can be markers

- **Restriction fragment length polymorphisms (RFLPs)** are sequences that restriction enzymes cut

- *Restriction enzymes* are proteins that cut DNA at one specific sequence

- **Microsatellites** are short repetitive sequences found throughout the genome

PRACTICE

1. The genetic distances between three genes (ab, nm, kf) were determined using a two-point mapping cross. Determine the sequence of the three genes.

    a. Ab – nm – kf
    b. Ab – kf – nm
    c. Kf – ab – nm

Gene	Distance
ab - nm	45
ab – kf	3
nm – kf	42

2. True or False: Recombination frequencies are never greater than 50%
    a. True
    b. False

3. Using the following data collected from a test cross, calculate the recombination frequency.

a. 15.9%
b. 10.3%
c. 40.5%
d. 32.7%

Phenotype	**Offspring**
Parental	1400
Parental	1200
Recombinant	150
Recombinant	150