How do we identify/study evolving pops?

Hardy-Weinberg Equilibrium Theorem- allele and genotype frequencies remain constant in a population between generations

- In a single locus diploid system with 2 alleles, *p* and *q*:

$$\boxed{p + q = 1 \longrightarrow 1 - p = q}$$

Thus, if q = 0.25, then p = 0.75

- **H.W.E. model** – allows us to compare a pop's **observed** genetic composition with the composition **expected** under equilibrium. To calculate expected genotypic freq. given an allele freq.:

$$\boxed{p^2 + 2pq + q^2 = 1}$$

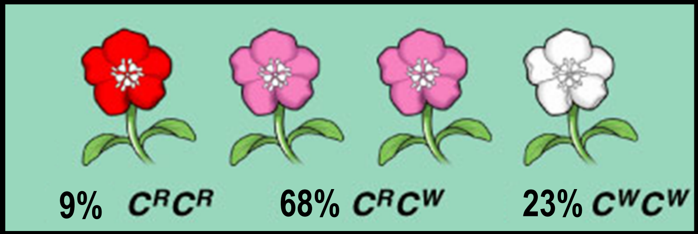
Homozygotes   Heterozgotes   Homozygotes

Thus, if q = 0.25, then $p^2 = 0.56$, $q^2 = 0.06$ and $2pq = 0.38$

If observed composition doesn't match expected, pop is not in equilibrium

Using Hardy-Weinberg

EXAMPLE: Population of 100 flowers. The *C* locus has two alleles, *R* and *W. There are 200 C alleles in the diploid pop. You observe the following genotype frequencies:*



QUESTION: Is population flower color evolving or is it stable?

FIRST: Calculate allele frequency for the *R* allele:

1. count number of red flowers, and multiply by 2, considering that there are 2 *R* alleles per red flower (i.e. 9 x 2 = 18).

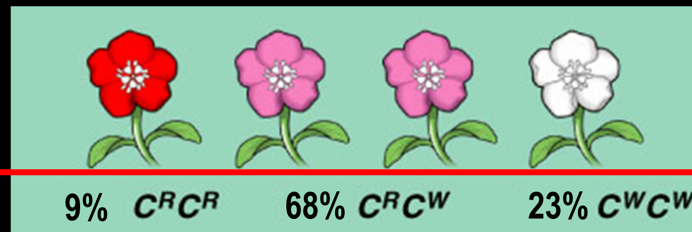
2. add the number of pink flowers (i.e. 18 + 68 = 86), considering there is only one *R* allele per pink flower.

3. Divide number of *R* alleles by total number of alleles (i.e. 86 / 200 = 0.43)

4. Thus, *R* = p = 0.43

Using Hardy-Weinberg

Observed ➡



SECOND: Calculate the expected genotype frequencies using the HWE model:

$$\boxed{p^2 + 2pq + q^2 = 1}$$

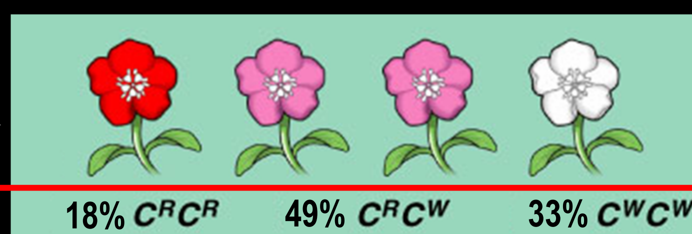
Based on a p 0.43, we expect:

Red: $p^2 = (0.43)^2 = 0.18$

Pink: $2pq = 2(0.43 \times 0.57) = 0.49$

White: $q^2 = (0.57)^2 = 0.33$

Expected ➡



The pop is not in equilibrium. Thus, flower color is evolving!