## Derivation of Hardy-Weinberg Ratios for dioecious organisms

Let individuals with genotypes **AA**, **AB**, & **BB** be distributed as $\mathbf{p^2 : 2pq : q^2}$
Let ratios in **females** & **males** be equal.

**I. Proportion of total offspring** contributed by each type of mating

| | $p^2$ **'AA'** | 2pq **'AB'** | $q^2$ **'BB'** |
|---|---|---|---|
| $p^2$ **'AA'** | | | |
| 2pq **'AB'** | | | |
| $q^2$ **'BB'** | | | |

**II. Expected genotype ratios** from each type of mating

| | **'AA'** | **'AB'** | **'BB'** |
|---|---|---|---|
| **'AA'** | | | |
| **'AB'** | | | |
| **'BB'** | | | |

**III. Expected proportions of genotypes** produced by each type of mating:
multiply proportions in (**I**) by expectations in (**II**)

| | $p^2$ **'AA'** | 2pq **'AB'** | $q^2$ **'BB'** |
|---|---|---|---|
| $p^2$ **'AA'** | | | |
| 2pq **'AB'** | | | |
| $q^2$ **'BB'** | | | |

Then, summing over genotypes

f(**AA**) = $p^4 + p^3q + p^3q + p^2q^2$ = $\mathbf{p^2}$

f(**AB**) = $p^3q + p^2q^2 + p^3q + 2p^2q^2 + p^2q^2 + pq^3$
= $2p^3q + 4p^2q^2 + 2pq^3$ = **2pq**

f(**BB**) = $p^2q^2 + pq^3 + pq^3 + q^4$ = $\mathbf{q^2}$

**Conclusion: random *matings* between *dioecious* organisms produce the same genotype ratios as random *union of gametes* in *monoecious* organisms**