Week 4 Highlights

Dihybrid Cross: Cross between two pure breeding individuals that differ from each other with respect to only two characters.

Parental Generation: Round, Yellow seeds X Wrinkled, Green seeds

F1 Generation: All progeny had Round, Yellow seeds

F2 Generation: 315 (Round, Yellow); 108 (Round, Green);
102 (Wrinkled, Yellow): 32 Wrinkled, Green)

Monohybrid F2 ratios were seen at both loci:
Round (423): Wrinkled(133) ~ 3:1
Yellow (416): Green (140) ~ 3:1

Therefore, the F2 ratio of a dihybrid cross is a product of the individual F2 probabilities predicted by the monohybrid cross:

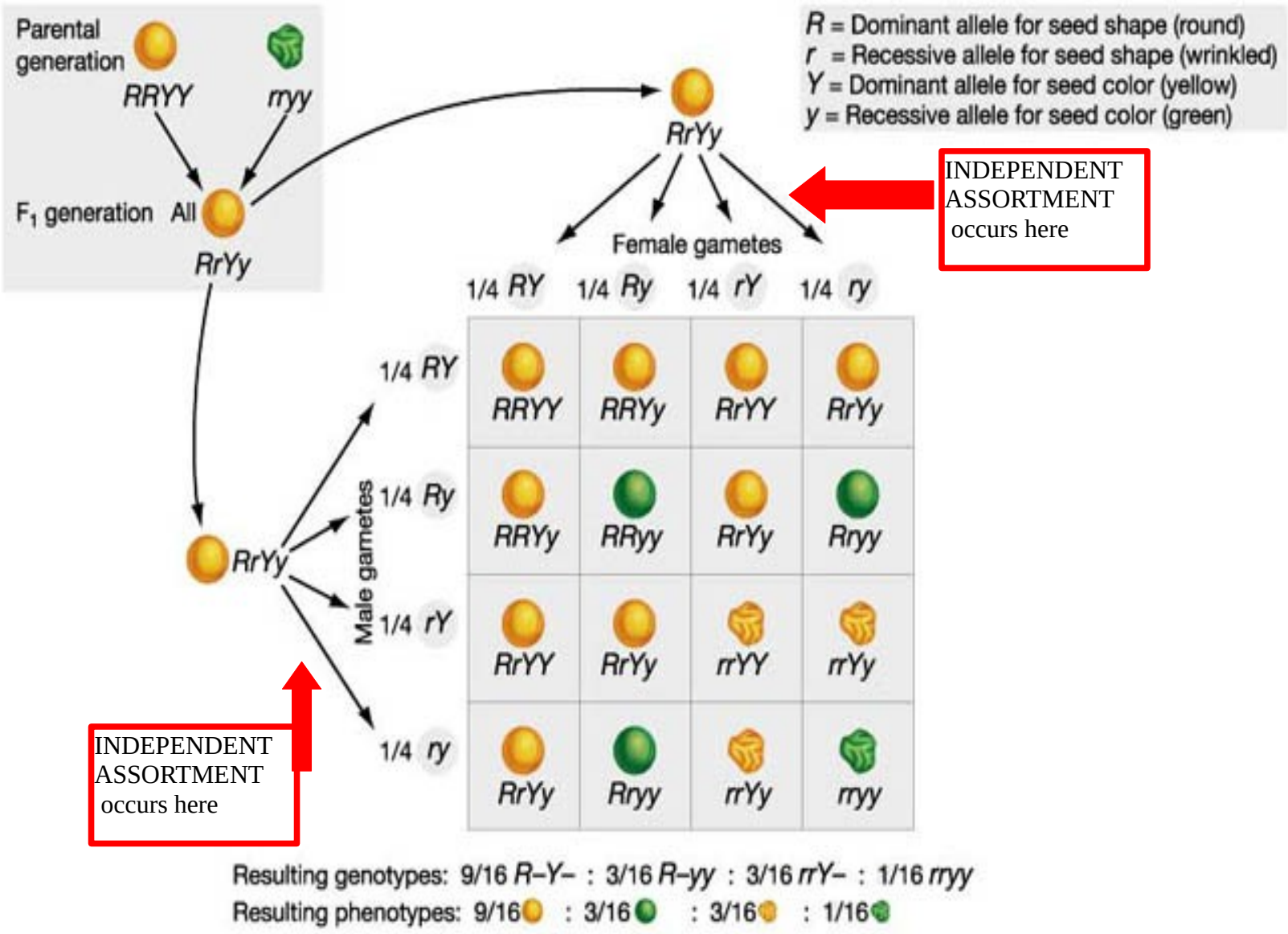
Phenotype	Probabilities as per monohybrid cross	Observed Numbers	Observed dihybrid F2 ratio
Round, Yellow	(3/4) X (3/4)	315	~ (9/16)
Round, Green	(3/4) X (1/4)	108	~ (3/16)
Wrinkled, Yellow	(1/4) X (3/4)	102	~ (3/16)
Wrinkled, Green	(1/4) X (1/4)	32	~ (1/16)

IF the genes for these traits are allocated to gametes independently of one another, ***then*** each F1 parent should produce four types of gametes, in equal frequencies

F1 Individual: RrYy

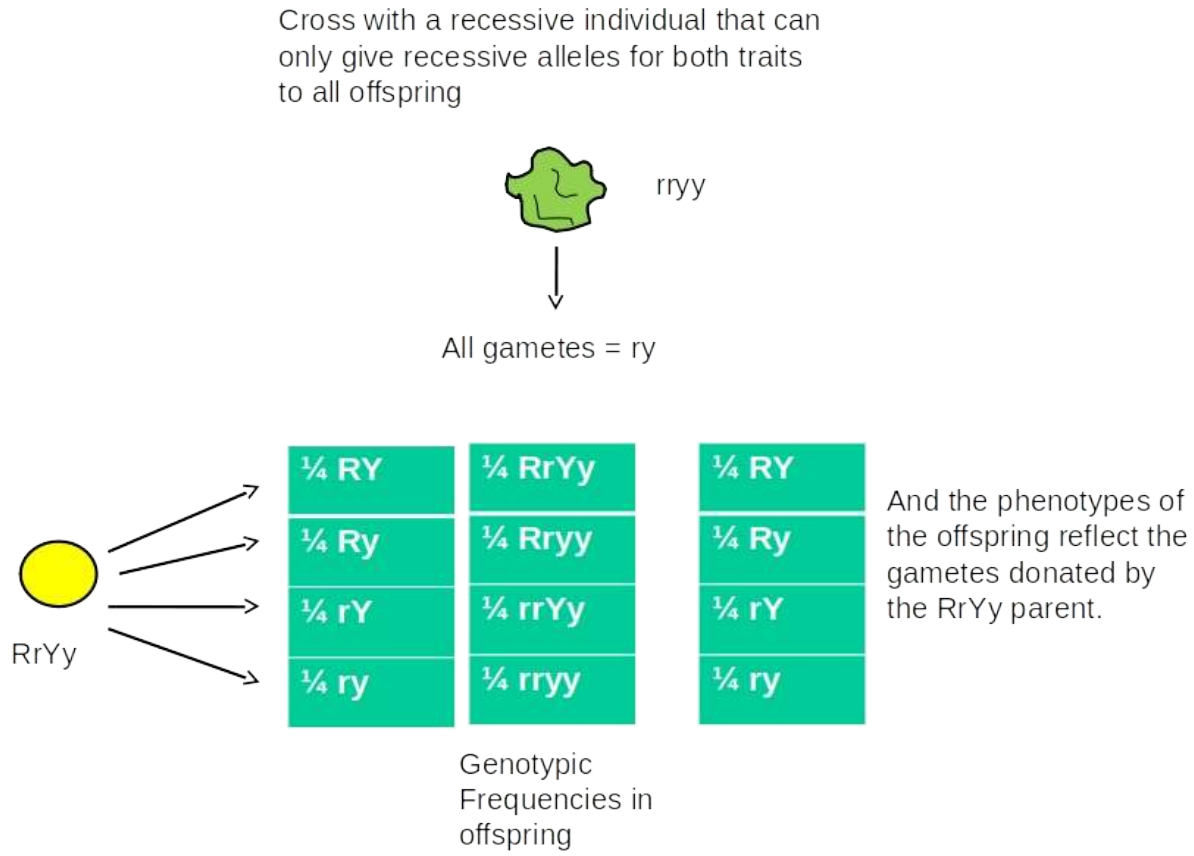
Gametes: RY (1/4): Ry (1/4): rY (1/4); ry (1/4)

Mendel's Principle of Independent Assortment: During gamete formation, the way one pair of alleles of one gene (governing one trait) segregate is not affected by (is independent of) the pattern of segregation of alleles of other genes (governing other trait); subsequent fertilization is random.



The union of gametes is random.

Dihybrid Test cross:



Summary of Mendel's studies:

1) Hereditary information is unitary and 'particulate', not blending.
2) First Principle – SEGREGATION: During gamete formation, the two particles governing a trait *separate* and go into different gametes; subsequent fertilization is random.
3) Second Principle – INDEPENDENT ASSORTMENT: The way genes for one trait separate and go into gametes *does not affect* the way other genes for other traits separate and go into gametes; so all gene combinations in gametes occur as probability dictates. Subsequent fertilization is random.

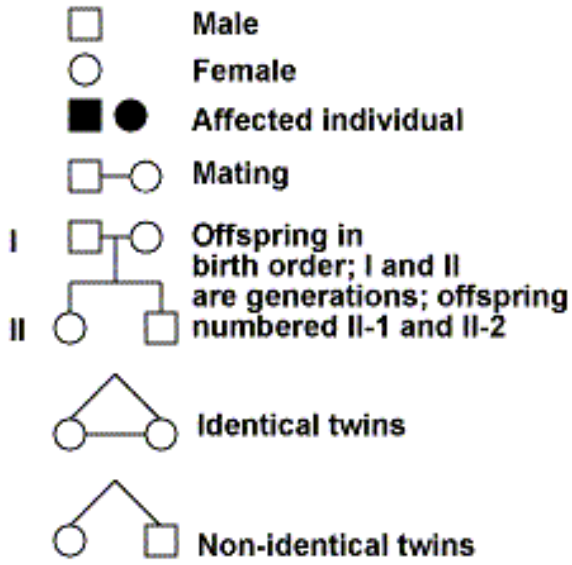
NOTE:
If we consider Mendelian crosses in **organisms where the sexes are separate** (for example, *Drosophila melanogaster*), **for genes that are present on the autosomes**, the following should be remembered-
In crosses (Monohybrid, Dihybrid etc.),
F1 ratio in male progeny = F1 ratio in female progeny
Similarly, **F2 ratio in male progeny = F2 ratio in female progeny.**

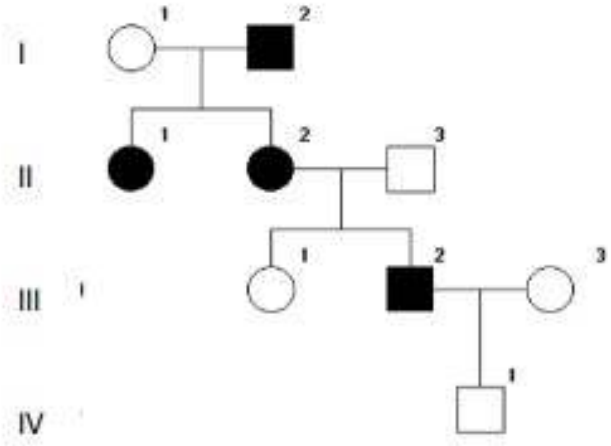
Pedigree Analysis

In all cases above, controlled crosses were performed to understand inheritance of characters. In many cases, such controled crosses cannot be performed. In such cases, existsing data from a population has to be used. One method of using such existsing data is Pedigree Analysis.

A Pedigree represents a family tree. It provides information such as males, females, parent-offspring relationship, affected individuals etc. Analysis of such a tree to explain the patterns of inheritance constitutes pedigree analysis.

The pedigree is drawn using a series of symbols. Some of these are-



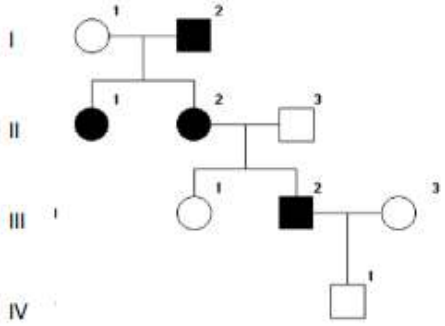


A pedigree chart displays a family tree, and shows the members of the family who are affected by a genetic trait.

This chart shows four generations of a family with four individuals who are affected by a form of colorblindness.

- Circles represent females and squares represent males.
- Each individual is represented by:
  - a Roman Numeral, which stands for the generation in the family,
  - a Digit, which stands for the individual within the generation.

  (For instance, The female at the upper left is individual **I-1**.)
- A darkened circle or square represents an individual affected by the trait.



- The "founding parents" in this family are the female I-1 and the male I-2 in the first generation at the top.
- A male and female directly connected by a horizontal line have mated and have children. These three pairs have mated in this tree:

  I-1 & I-2, II-2 & II-3, III-2 & III-3
- Vertical lines connect parents to their children. For instance the females , II-1 and II-2 are daughters of I-1 and II-2
- The "founding family" consists of the two founding parents and their children, II-1 and II-2.

Some more notations: