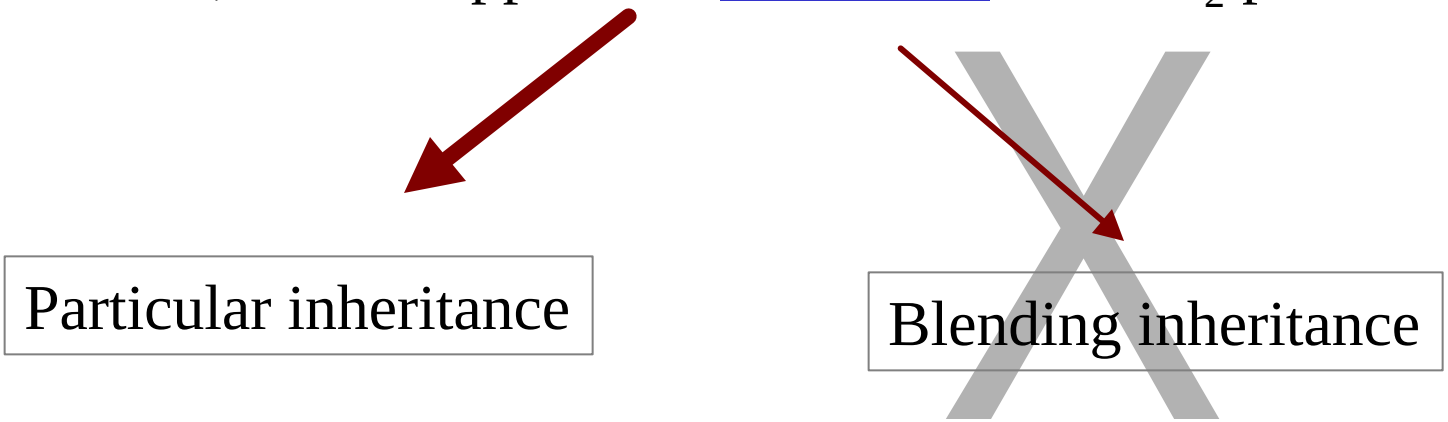
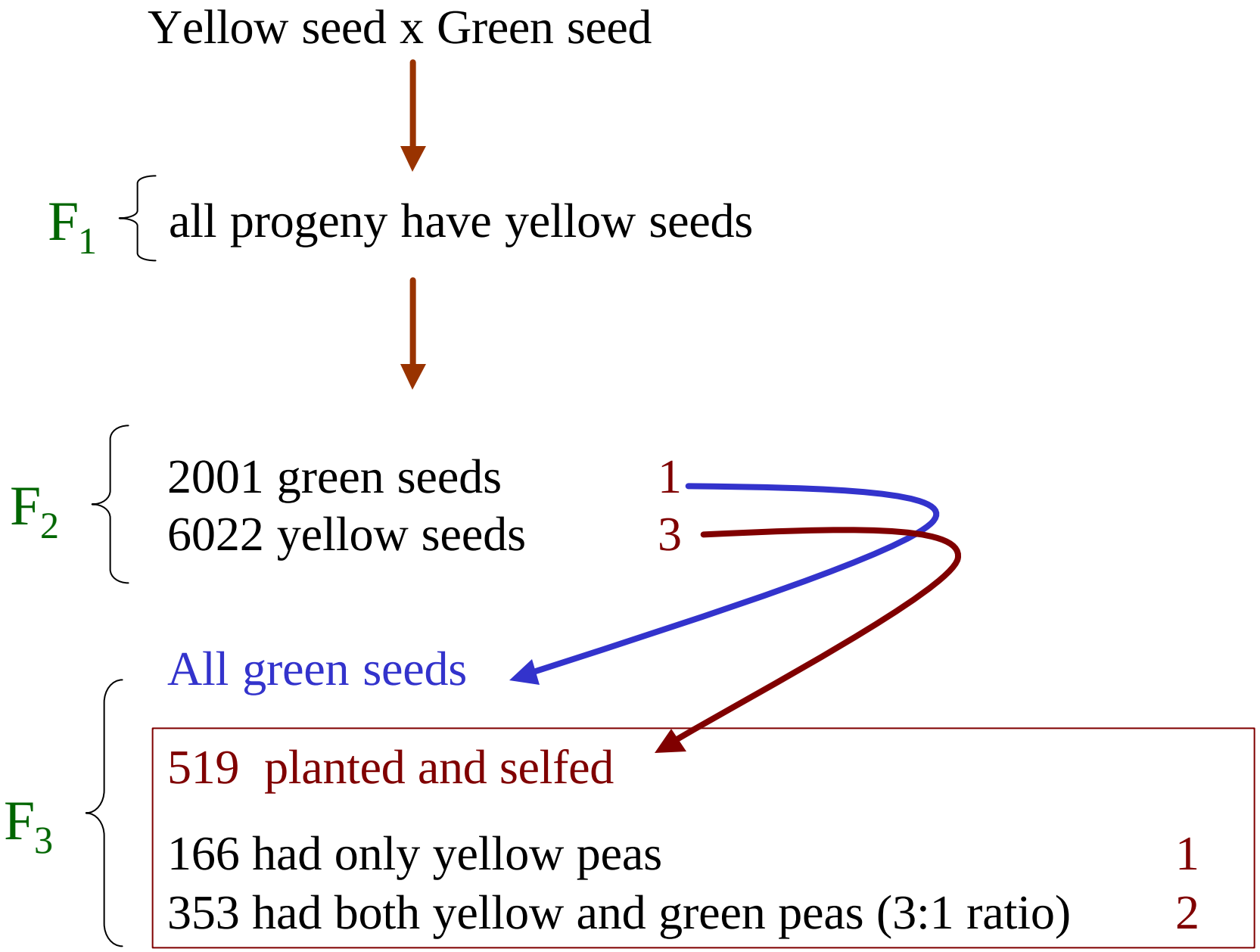
1. Mendel found the same 3:1 ratio in the F_2 generation for each of the seven pair of characters he examined

2. The white phenotype is completely absent in the F_1 generation, but it reappears in one-fourth of the F_2 plants



Even though F_1 flowers are purple, the plants must carry the potential to produce progeny with white flowers

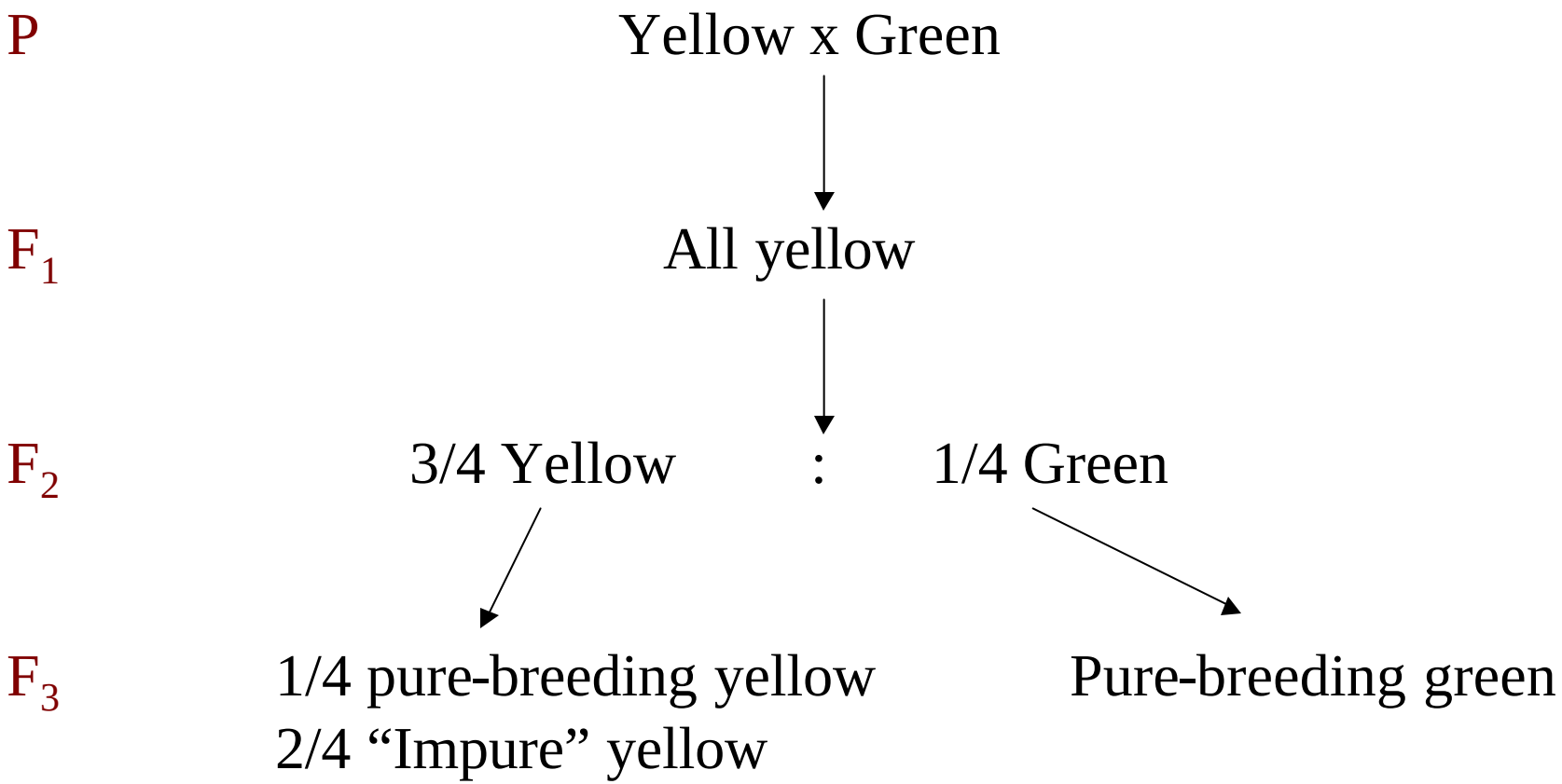

Yellow seed x Green seed
F1
all progeny have yellow seeds
F2
2001 green seeds
6022 yellow seeds
1
3
All green seeds
F3
519 planted and selfed
166 had only yellow peas
353 had both yellow and green peas (3:1 ratio)
1
2

1. Mendel found the same 3:1 ratio in the F_2 generation for each of the seven pair of characters he examined

2. The green seed phenotype is completely absent in the F_1 generation, but it reappears in one-fourth of the F_2 plants

3. All of the F_2 green peas were pure-breeding greens like one of the parents

4. Of the F_2 yellows, about 2/3 were like the F_1 yellows (producing yellow and green seeds in a 3:1 ratio when selfed), and the remaining 1/3 were like pure-breeding yellow parent



Thus, F_2 ratios are 1 : 2 : 1

Pure yellow Impure yellow Pure green

1. Mendel found the same 3:1 ratio in the F_2 generation for each of the seven pair of characters he examined

2. The recessive phenotype is completely absent in the F_1 generation, but it reappears in one-fourth of the F_2 plants

3. 1:2:1 ratios exist in all of the apparent 3:1 ratios that were observed in F_2 plants (data obtained from F_3 studies)

Observation

Hypothesis

A guess as how things are working based on the observations

Mendel's Hypothesis

1. *There are hereditary determinants of a particular nature.* He saw no blending of phenotypes. We now call these determinants genes.

2. *Each adult pea has two genes (*a gene pair or allele*) in each cell for each character studies.* The reasoning: the F_1 plants, for example, must have had one gene responsible for the dominant phenotype (dominant gene) and one gene for the recessive phenotype (recessive gene), which only showed up in later generations.

Mendel's Hypothesis

3. *During sex-cell (*gamete*) formation, the members of each gene pair segregate (*separate*) equally into the sex cells.*

Law of Segregation

3. *Consequently, each sex cell (*i.e. pollen or egg cell*) carries only one gene for each character.*

4. *The union of sex cells, to form the first cell (*zygote*) of a new progeny individual, is random and occurs irrespective of which member of a gene pair (*allele*) is carried.*

Law of independent assortment

- Using A to represent the dominant gene
- Using a to represent the recessive gene
- Knowing that the number of genes are constant from one generation to the next
- Thus, the sex cells (gametes) must carry half (i.e. 1 copy) the number of genes of the parent
- Zygote is formed from the union of sex cells of the parents restoring the number of genes of the offspring to that of the parents
- Mendel’s hypothesis can the be illustrated diagrammatically

P

AA x aa

Points 1 & 2

Sex cells

A only a only

Point 4

F_1

Aa (Zygote)

Point 3

F_2

Eggs produces

Pollen produced

	1/2 A	1/2 a
1/2 A	1/4 AA	1/4 Aa
1/2 a	1/4 Aa	1/4 aa

Point 5

Total = 1AA : 2Aa : 1aa

Prediction

- If an F_1 yellow (progeny from the cross of pure-breeding yellow seed to pure-breeding green seeds) is crossed to a pure-breeding green following is predicted:

  - ✓ If the hypothesis is correct 1:1 ratio of yellow to green seeds is expected

  - ✓ If the hypothesis is incorrect ratios other than 1:1 should be observed

Prediction

F_1 Yy (yellow) x yy (green)

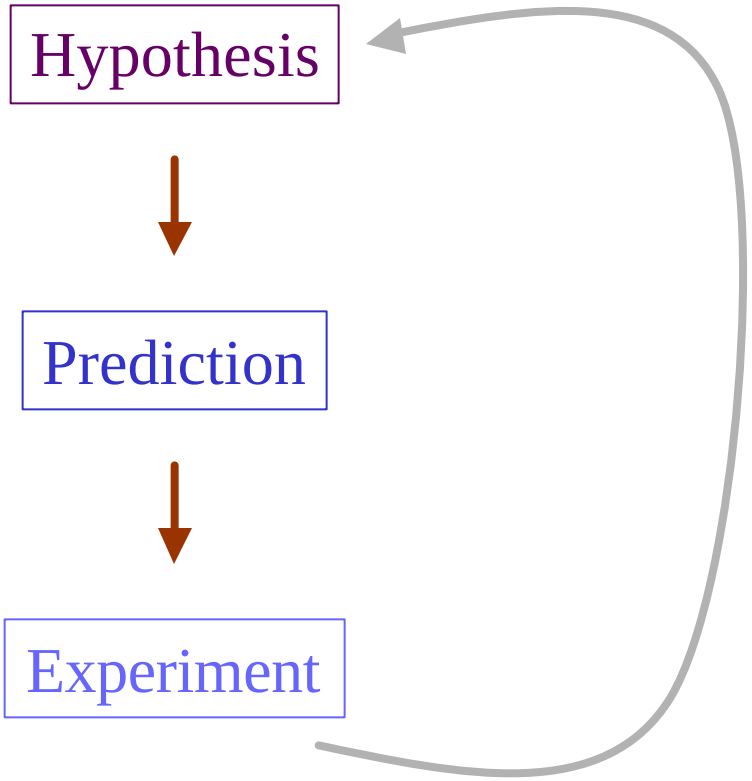
Sex cells 1/2 Y and 1/2 y | y only

	y
1/2 y	1/2 yy
1/2 Y	1/2 Yy

Predicted progeny ratio is 1 yellow : 1 green

Experiment

- ✓ Performing the experiment, Mendel obtained 58 yellow and 52 green seeds. A very close approximation to the predicted 1:1 ratio.



Terminology

Heterozygote = individuals represented by Aa (i.e. those whose progeny will segregate)

Homozygote = individuals represented by AA or aa (i.e. true-breeding, pure lines)

Dominant = form of the gene that dominates, as observed by the phenotype, in the heterozygote state

Recessive = form of the gene that is not observed phenotypically in the heterozygote state

Homozygote dominant = AA

Homozygote recessive = aa

Sex cells = gametes

Genotype = Genetic constitution with respect to the character(s) under study

Alleles = Alternate form of the same gene (i.e. A vs. a)