

Mendelian Genetics

Before 1860

- Sperm and egg contain a sampling of essences from the various parts of the parental body
- Offspring typically show some characteristics similar to those of both parents



Blending inheritance



However, this is not always true (i.e. dark hair vs. light hair)

Observation



Hypothesis

A guess as how things are working based on the observations



Prediction



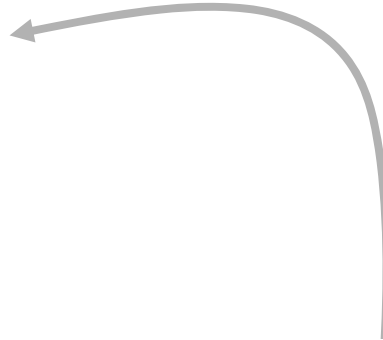
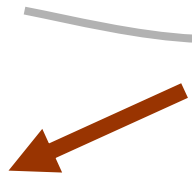
Experiment

This is performed to test the hypothesis.



New hypothesis

If experiments/data do not support the hypothesis develop a new one



Mendelian Genetics

1866

- An Augustinian monk named Gregor Mendel reported the results of his experiment with various strains of peas
- His evidence formed the foundations of modern Genetics



Particular inheritance



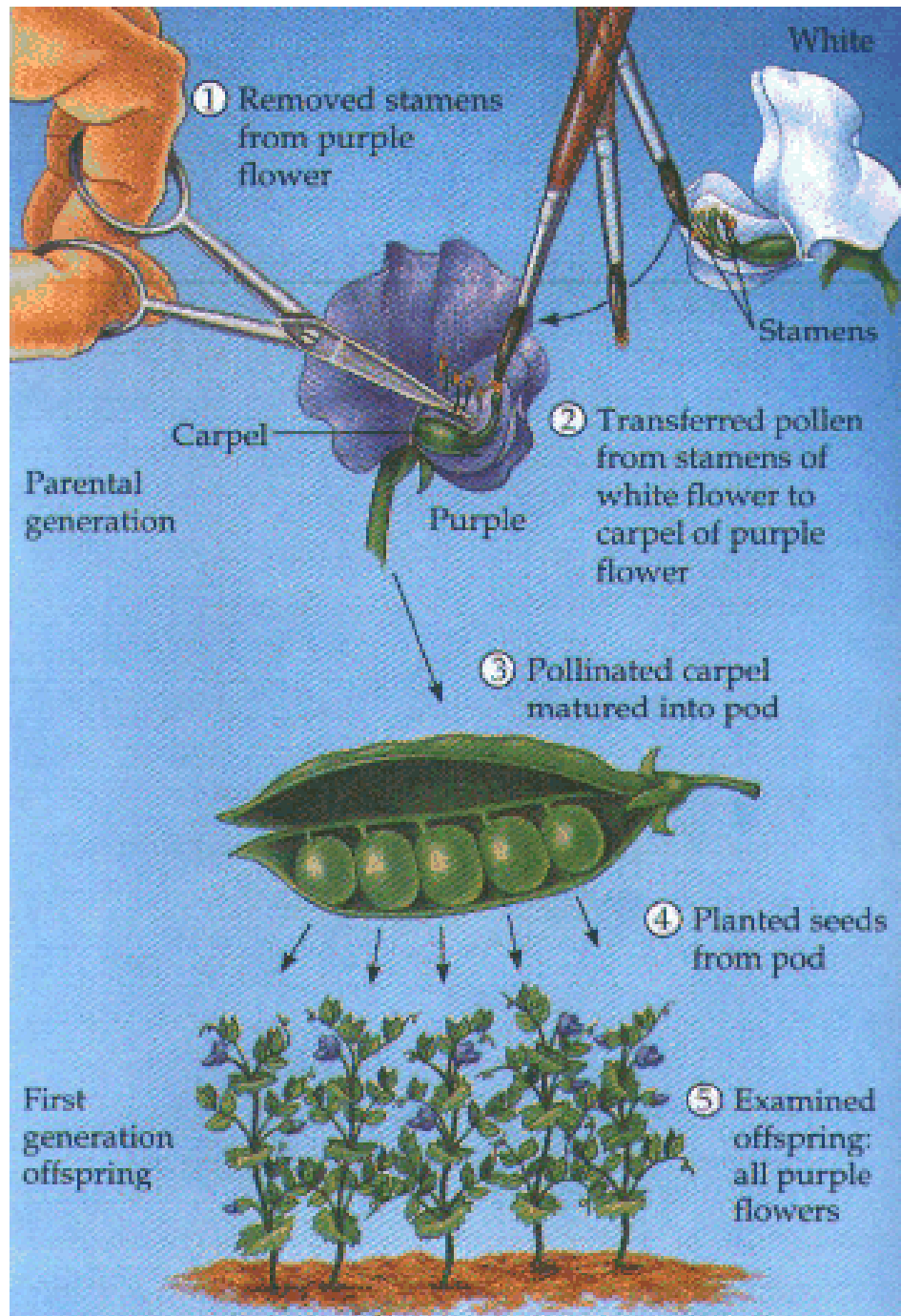
A genetic determinant of a specific character is passed from one generation to the next as a unit, without any blending of the units

Mendel's Experiments

Experimental species garden pea (*Pisum sativum*)

1. Peas were available in easily identifiable array of distinct shapes and colors through a seed merchant
2. Peas left to themselves will **self-pollinate** because both parts of the flower (male and female) are enclosed in a petal box
3. Pea plants can easily be **crossed** to each other by manipulation of the flowers



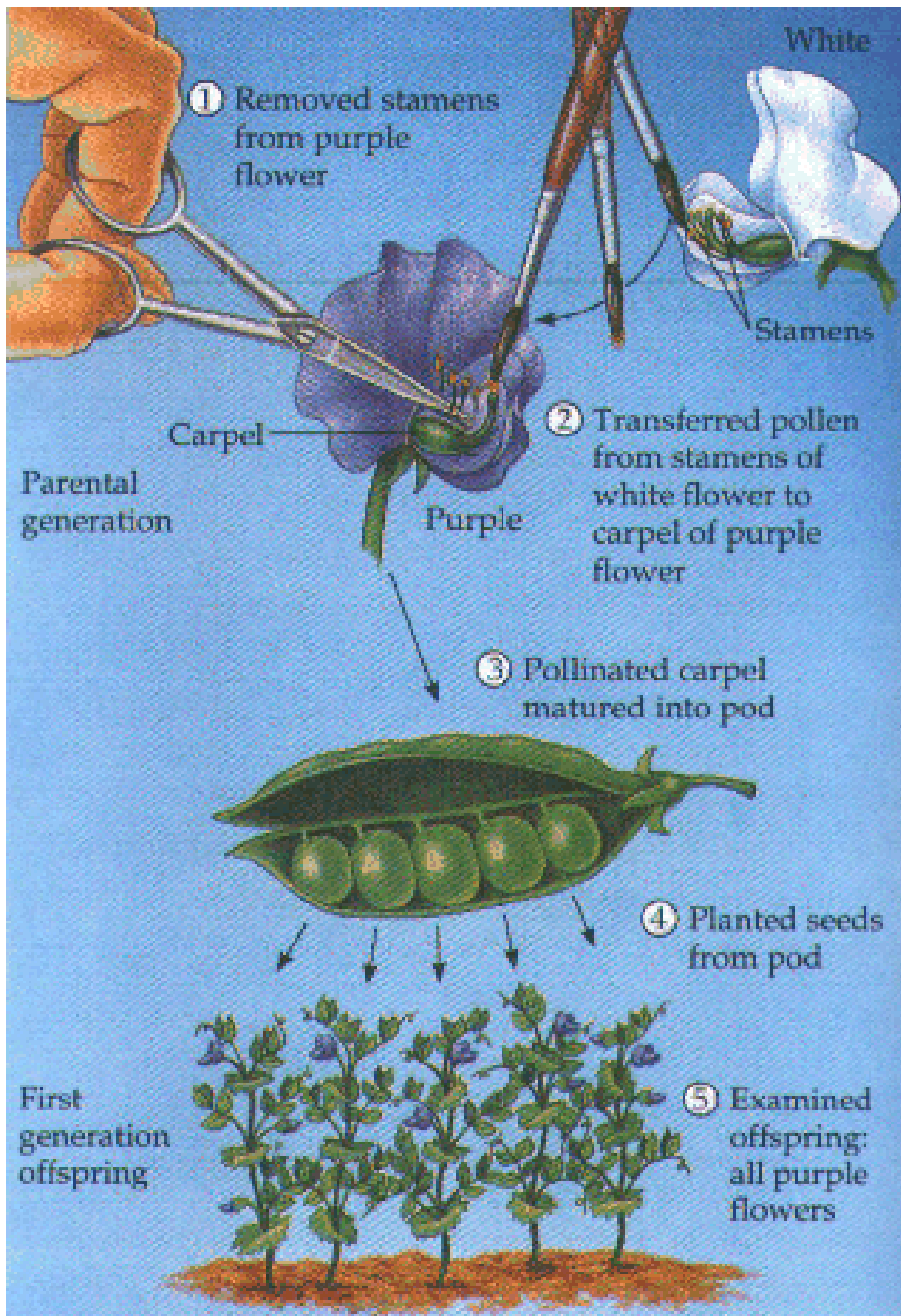


Mendel's Experiments

1. Mendel chose several easily distinguishable characters (phenotype) to study (i.e. flower color)
2. He established **pure lines** of plants for these phenotypes by selfing (i.e. flower color)



Pure line is a population that breeds true for the particular phenotype being studied; that is all offspring produced by selfing or crossing within this population show the same form for this phenotype.



Parental generation

white flower x white flower



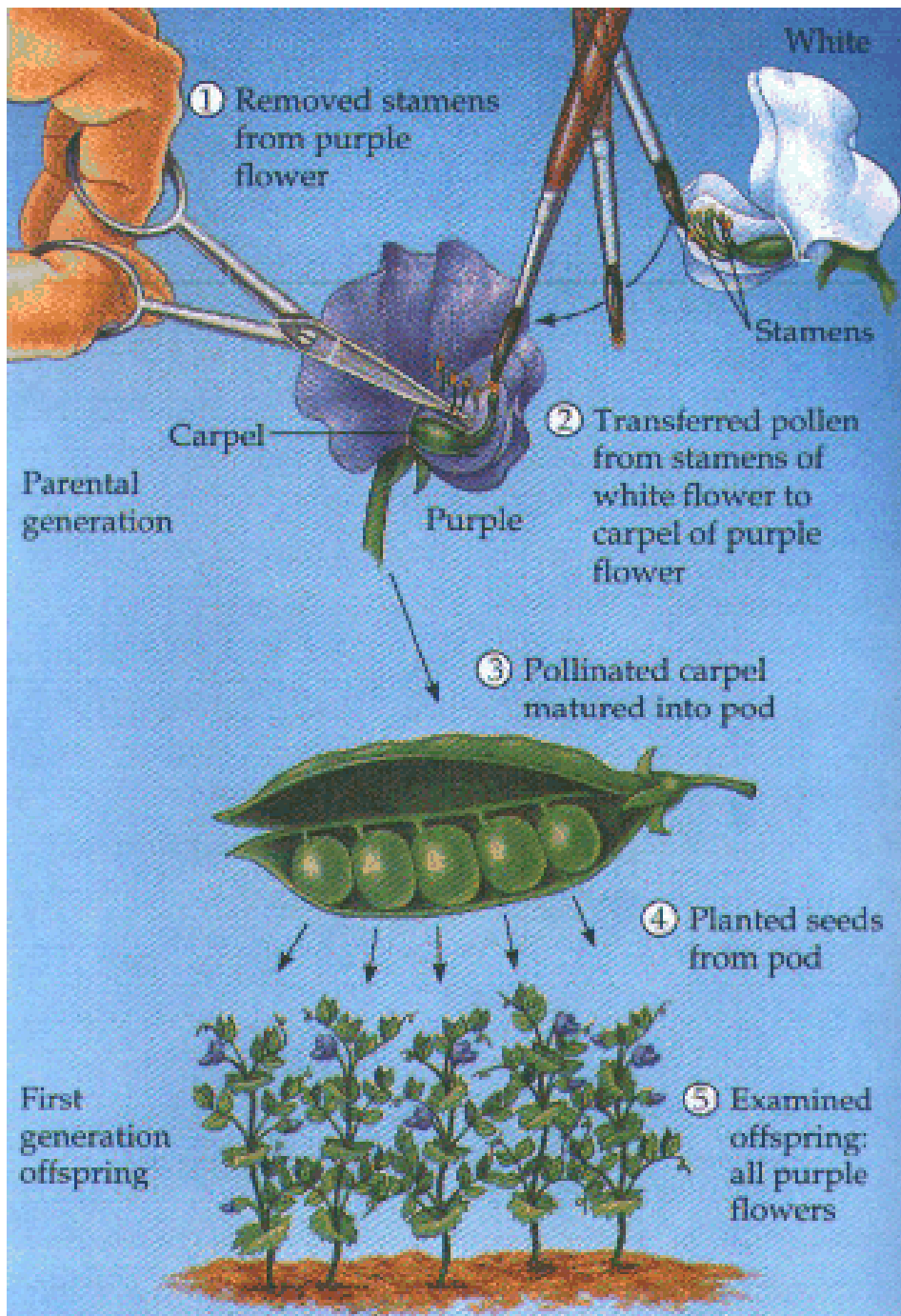
all progeny have white flowers

First filia generation (F₁)

Purple flower x purple flower



all progeny have purple flowers



white flower x purple flower



all progeny have purple flowers

Purple flower x white flower



all progeny have purple flowers

Reciprocal crosses

white flower x purple flower



all progeny have purple flowers



Mendel Selfed these plants to generate F₂ generation.
He obtained 929 seeds from this selfing.



Amazingly 224 of the resulting plants had white flowers,
the rest 705 had purple flowers.

white flower x purple flower



all progeny have purple flowers

Purple flower color is **dominant**
over white flower color

or

Purple flower x white flower



all progeny have purple flowers

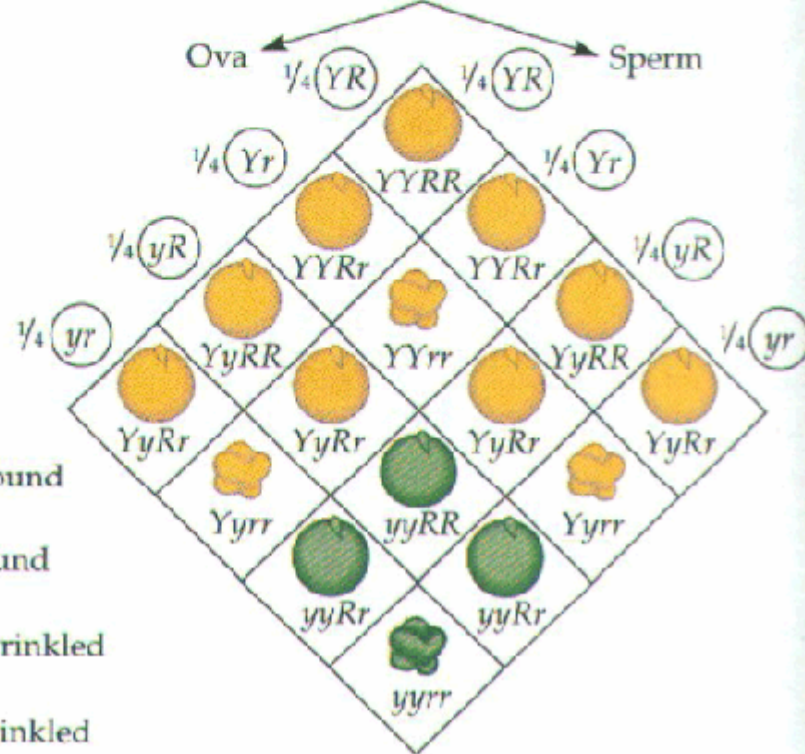
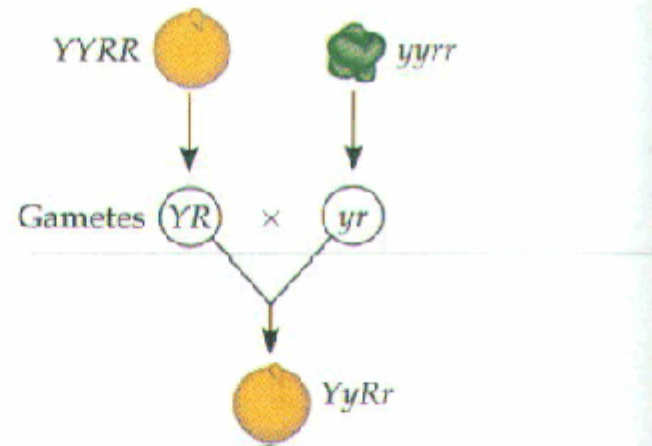
White flower color is **recessive**

Examples of dominant characters in pea:

- White flower over purple flower
- Round seed over wrinkled seeds
- Yellow seed color over green seed color
- Inflated pods over pinched pods
- Green pods over yellow pods
- Axial flowers over terminal flowers
- Long stems over short stems















Results of all Mendel's crosses in which parents differed for one character

	Parent phenotypes	F ₁	F ₂	F ₂ ratio
1	Round x Wrinkled seeds	All round	5474 round: 1850 wrinkled	2.96:1
2	Yellow x Green seeds	All yellow	6022 yellow: 2001 green	3.01:1
3	Purple x White petals	All purple	705 purple: 224 white	3.15:1
4	Inflated x Pinched pods	All inflated	882 inflated: 299 pinched	2.95:1
5	Green x Yellow pods	All green	428 green: 152 yellow	2.82:1
6	Axial x Terminal flowers	All axial	651 axial: 207 terminal	3.14:1
7	Long x Short stems	All longs	787 long: 277 short	2.84:1



- $\frac{9}{16}$ Yellow-round
- $\frac{3}{16}$ Green-round
- $\frac{3}{16}$ Yellow-wrinkled
- $\frac{1}{16}$ Green-wrinkled

Table 14.1 The Results of Mendel's F₁ Crosses for Seven Characters in Pea Plants

Character	Dominant Trait	×	Recessive Trait	F ₂ Generation Dominant:Recessive	Ratio
Flower color	 Purple	×	 White	705:224	3.15:1
Flower position	 Axial	×	 Terminal	651:207	3.14:1
Seed color	 Yellow	×	 Green	6022:2001	3.01:1
Seed shape	 Round	×	 Wrinkled	5474:1850	2.96:1
Pod shape	 Inflated	×	 Constricted	882:299	2.95:1
Pod color	 Green	×	 Yellow	428:152	2.82:1
Stem length	 Tall	×	 Dwarf	787:277	2.84:1