Mendelian Genetics

Chapter 14 in Campbell et al.

Secrets to success in learning Mendelian genetics

- 1. Do problems
- 2. Learn the vocabulary
- 2. Do some more problems
- 3. Repeat as necessary

- If you do lots of problems, these questions will become almost automatic - you'll recognize each type of problem and know how to solve it.

Some background and vocabulary…

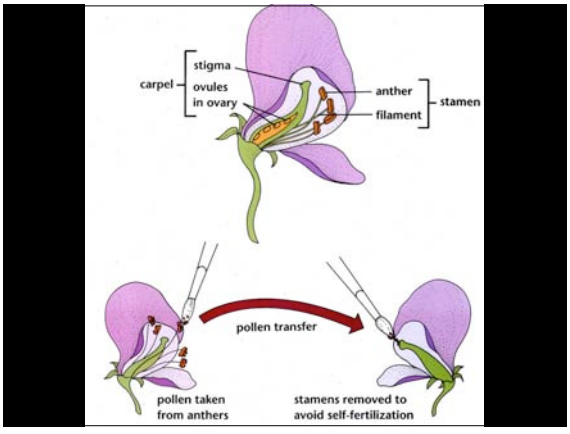
- The transfer of genetic information from parent to offspring is called heredity.
- Before chromosomes or DNA were discovered, before the physical nature of genes was known, people studied how heredity looked by examining the physical appearance of animals and plants, especially domesticated ones.
- In the study of heredity, the phrase **hybrid mating** is used to describe mating between two different **varieties** (physical types) of the same species.

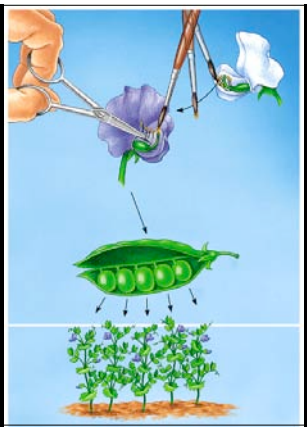
What Mendel Knew

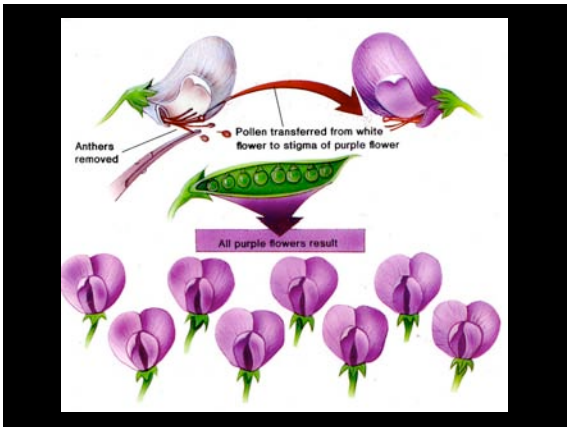
- Some **traits** are inherited
- It's more complex than "everyone looks like their parents." It's more complex than "**blending**" of parental traits.
- Some varieties of domestic plants are **true-breeding**, some not.
- Some traits may "skip" generations
- Hybrid plants (offspring of two dissimilar parents) often resemble each other.
- When hybrids are mated to each other, some of the offspring look like their parents, some look like grandparents (hybrids are *not* true-breeding).

The advantages of peas…

- Many variants available in **true-breeding** lines
- Peas are easy to cultivate
- Can control fertilization (**selfing**, **crossing**)
- Mm, mm, good!





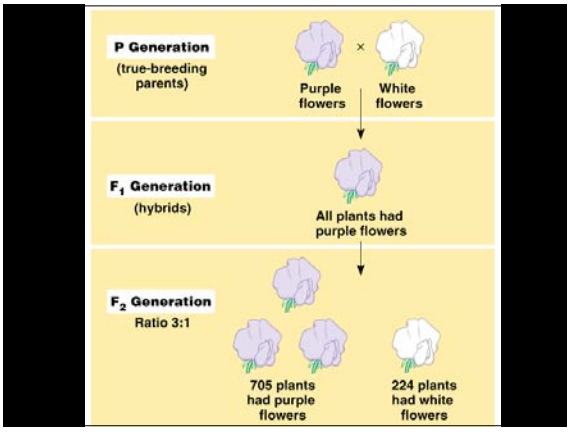


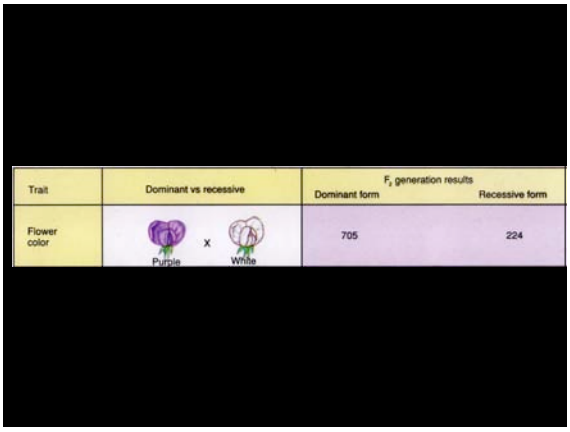
- Mendel was smart - used <u>either-or</u> traits and carefully counted offspring

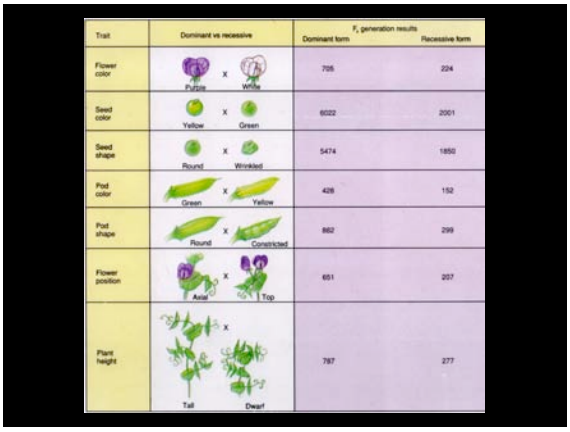
More words

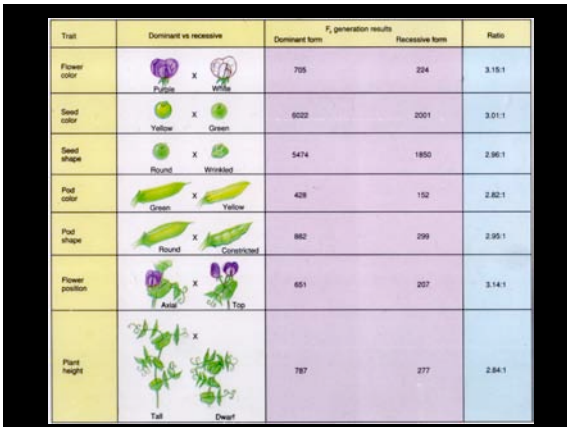
Generations -

- Parental or "P" generation
- First filial or "F1:" offspring of "P"
- Second filial, "F2," offpsring of F1









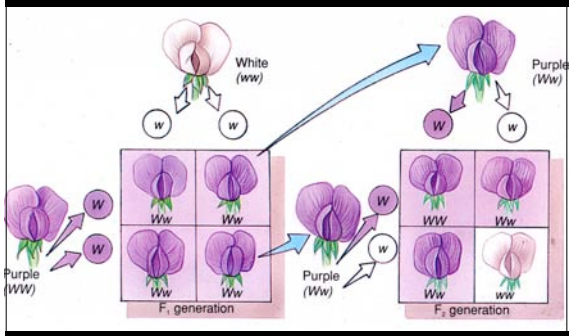
Mendel's data

- Starting with true-breeding lines
- All F1s of a hybrid cross resemble the dominant parent
- F2s are in the ratio 3 dominant :1 recessive

Mendel concluded…

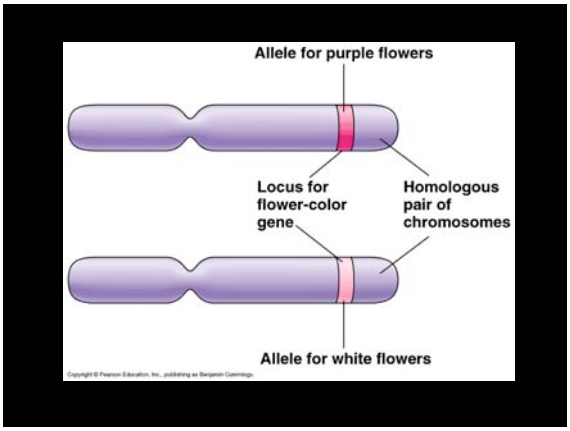
- Inheritance isn't by blending, it's particulate
- Each individual has two particles that carry hereditary information
- The two particles **segregate** in reproduction - each parent passes on only one of its two particles (*principle of segregation*)
- Some types of particles are dominant

Punnett square method



Still more words…

- Gene - a unit of hereditary information
- Locus - the place on the chromosome where a given gene is found (nearly synonomous with "gene")
- Allele - one form of a gene. Different alleles are found at the same locus on homologous chromosomes.
- Homozygous - having two identical alleles at a locus (remember, we're diploid, so we have two homologous chromosomes of each type, and two alleles of each gene)
- Heterozygous - having two different alleles at a locus



Now we can state it clearly

- A dominant allele masks the expression of a recessive allele

How to do a Punnett square

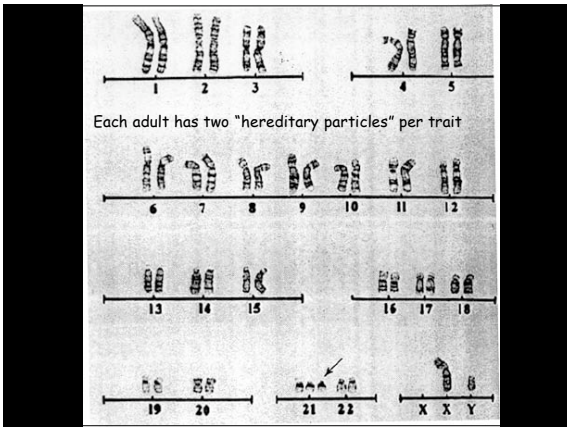
- Figure out the parental genotypes. Write one on top, one on the left
- Figure out the gametes that each parent can produce. Write them in
- Combine the gametes, count the resulting genotypes, and figure out the phenotypes.

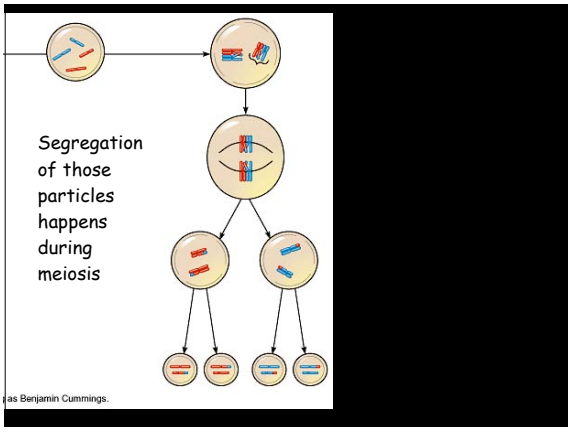
Dihybrid cross

- What happens if you cross two varieties that differ in *two* traits?
- Example: Parents are true-breeding purple flowers and yellow seeds x white flowers and green seeds
- Purple = W (dominant), white = w
- Yellow = G (dominant), green = g
- Figure out the genotypes and phenotypes of F1 and F2 generations

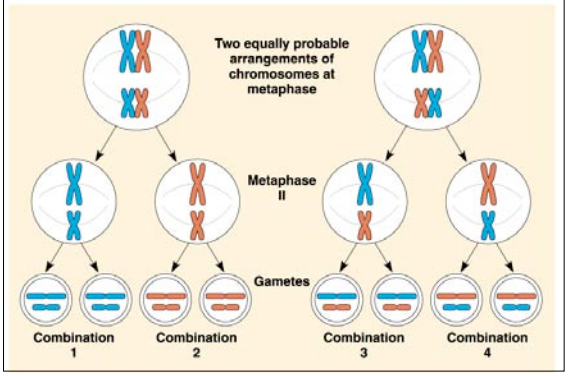
Mendel's work summarized

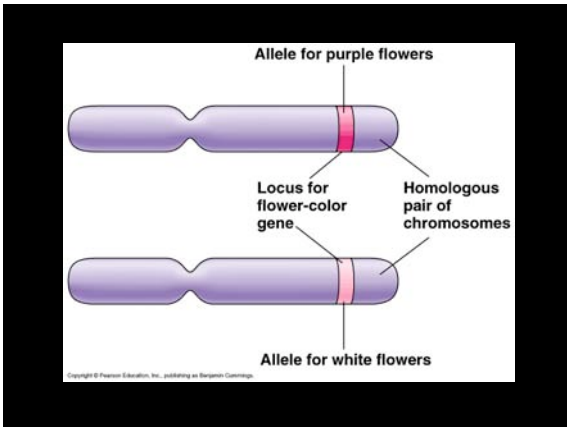
- Each adult has two alleles
- During reproduction, the two alleles segregate (principle of segregation)
- Alleles from different loci segregate independently (principle of independent assortment)
- Can we relate these conclusions back to what we know about meiosis?

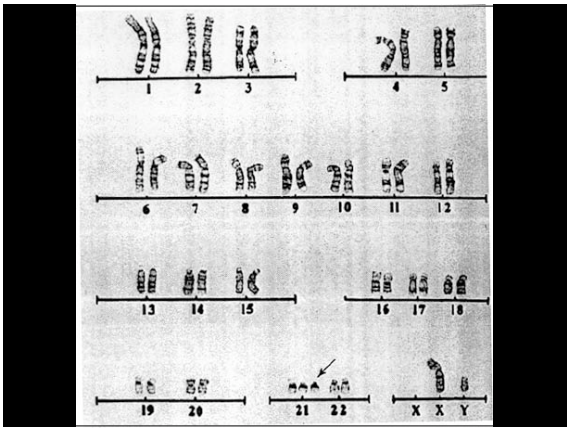




Independent assortment







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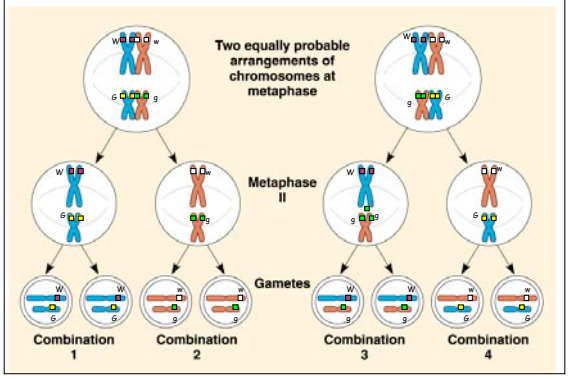

Beyond Mendel

- Mendel dealt only with simple either-or traits
- Not all inherited traits work that simply