Chapter 11 GENETICS Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period\_\_\_\_\_\_\_

* 1. The work of Gregor Mendel

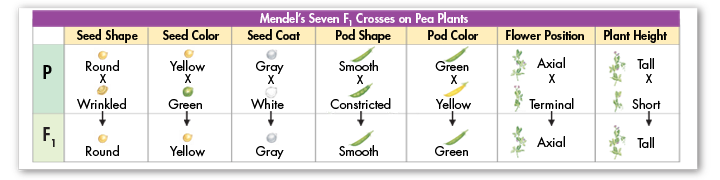
**Genetics** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (passing down of characteristics from parent to offspring)

-Gregor Mendel = “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”

- Born in 1822 – Austrian monk

- Worked with pea plants that were self-pollinating and true-breeding (the offspring always looked like the parent)

-Mendel cross pollinated his true-breeding plants



-The original pair of plants is called the **\_\_\_\_\_\_\_\_\_\_**(parental generation)

-The offspring are called the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (first filial generation)

* + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = offspring of crosses between parents with different characteristics
  + **Trait** = a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (pea color, hair color)
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = the factors that are passed from parent to offspring
  + **Allele** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Mendel’s Conclusions

-An individual’s characteristics are determined by factors (**genes**) that are passed from one parental generation to the next

**-Principle of dominance** = some alleles are dominant and some are recessive

* + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = need one allele (form of the gene) for the trait to be expressed
  + **Recessive** = need \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the trait to be expressed
  + **Gametes** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (sperm, egg, pollen, ovule)

-During the formation of gametes, the alleles for the trait separate from each other

* + Each gamete gets 1 **allele** (copy of the gene)

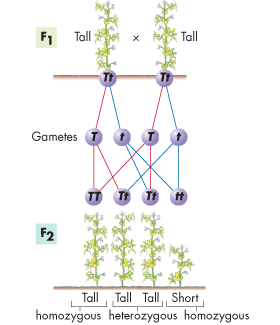
-When fertilization occurs – the plant gets one allele from each parent (2 total)

11.2 Applying Mendel’s Principles

-Mendelian genetics is based on **probability** = the likelihood that an event would occur

**-Dominant** alleles are written in **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** T = tall

**-Recessive** alleles are written in **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** t = short



* In this example:

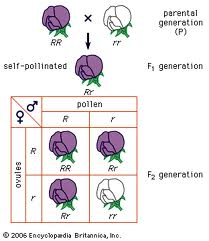
-There is a 50% chance that the plant the offspring will get a

“T” allele

-There is a 50% chance the plant will get a “t” allele

* **Genotype** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of an organism
  + **Homozygous**=organisms that have two \_\_\_\_\_\_\_\_\_\_\_alleles for a gene (BB or bb)
  + **Heterozygous**=organisms that have two \_\_\_\_\_\_\_\_\_\_\_\_\_\_ alleles for a gene (Bb)
* **Phenotype** = the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of an organism

For each example, write the genotype and phenotype.



1) The Rr flower

Genotype - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

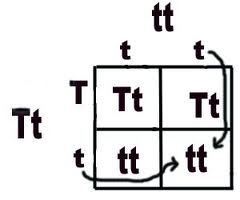
Phenotype – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2) The rr flower

Genotype - \_\_\_\_\_\_\_\_\_\_

Phenotype - \_\_\_\_\_\_\_\_\_\_\_\_

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = a diagram that uses probability to predict the possible genotype and phenotype combination in crosses



T = tall

t = small

(choose a letter from the dominant allele)

In peas, yellow seeds are dominant to green. Complete the following cross Yy x yy

1. Make a key – yellow = \_\_\_\_\_\_\_

Green = \_\_\_\_\_\_\_

1. Parental genotypes (if not given) yy x Yy
2. Set up the punnett square
3. Figure out the phenotypic and genotypic ratio

Phenotypic ratio: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Genotypic ratio: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

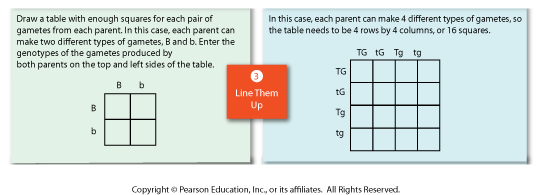
DIHYBRID CROSS

* When there are 2 traits it is a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_cross**.
* Genes for different traits can segregate independently during the formation of gametes

EXAMPLE PROBLEM

Cross two plants that are heterozygous for height and pod color. Tall is dominant to short and green pods are dominant to yellow

**Step 1** – Make a key and determine the parents



Tall = \_\_\_\_\_\_\_\_ Green = \_\_\_\_\_\_\_

Short = \_\_\_\_\_\_\_\_ Yellow = \_\_\_\_\_\_\_\_

**Step 2** – Write the genotypes of the parents

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_x \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Step 3** – Determine the possible allele combinations for the gametes

TtGg = \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

Tt Gg = \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

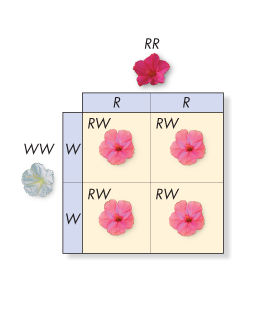
**Step 4** – Set up the 16 square Punnett square

**Step 5** – Complete the Punnett square

**Step 6** – Determine the phenotypic ratio

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11.3 Exceptions to Mendel’s rules



1. **\_\_\_\_\_\_\_\_\_\_dominance**=one allele is not completely dominant over another

-Phenotype is a combination of the two alleles

EXAMPLE: Four o’clock flowers

R = Red

W = White

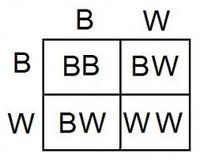
What are the genotypes of the following?

Red \_\_\_\_\_ White \_\_\_\_\_\_ Pink\_\_\_\_\_\_

What are the phenotypes of the following?

RR \_\_\_\_\_\_\_\_\_ RW\_\_\_\_\_\_\_\_ WW\_\_\_\_\_\_\_

1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = both alleles are seen in phenotype



* + The phenotype shows each allele NOT a combination

Example – Some varieties of chickens

W = White

B = Black

WW = \_\_\_\_\_\_\_\_\_ BB = \_\_\_\_\_\_\_\_\_\_\_ BW = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the phenotypic ratio when you cross two BW chickens?????

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **\_\_\_\_\_\_\_\_\_\_\_alleles** = there are more than \_\_\_\_ alleles for a trait

* Example – rabbit’s fur color, human blood types

4) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = traits produced by more than one gene

- Examples – human skin color and height

-Genes provide a plan for development, but environment also plays a role in phenotype

* 1. Meiosis

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = the process in which the number of chromosomes per cell is cut in half

* + Occurs through separation of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chromosomes** (matching chromosomes from a female and male parent)
  + Creates **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** (sex cells – sperm, eggs, pollen, etc.)
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**= a cell that contains both sets of homologous chromosomes (2N)
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = a cell that contains a single set of chromosomes (N)

- Meiosis has two divisions (before meiosis 1 the cell is in interphase and replicates the chromosomes)

**Meiosis 1**

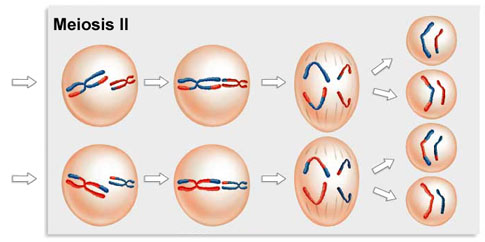
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_1**
* Each chromosome matches with its holomogous chromosome (forms a **tetrad**)
* **Crossing over** occurs (chromatids cross over and exchange ends)
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1**
* Homologous chromosomes line up in the center of the cell
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1**
* Homologous chromosomes are pulled toward opposite ends of the cell by spindle fibers
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1**
* Nuclear membrane forms around each nucleus
* Cytokinesis follows



At the end of meiosis 1 there are two daughter cells

* Each has 1 set of chromosomes (is haploid)
* Chromosomes do not replicate before Meiosis II

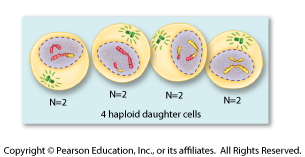
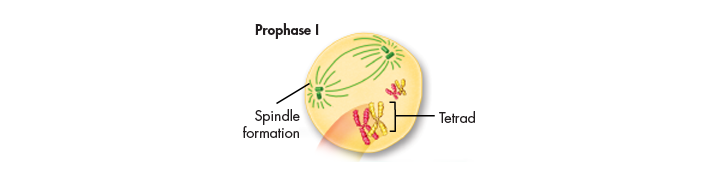
**Meiosis II**



* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ II**
* Chromosomes become visible
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ II**
* Chromosomes line up at the center of the cell
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ II**
* Chromatids separate
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ II**
* The nuclear membrane reforms

The result of Meiosis

* The result of meiosis is 4 haploid (N) daughter cells
* In our example each cells has 2 chromosomes (1/2 of the starting number)



ORIGINAL CELL (\_\_\_\_\_\_chromosomes) 4 DAUGHTER CELLS (\_\_\_\_\_\_ chromosomes)

Gene linkage

-Alleles of different genes tend to be inherited together when those genes are located on the same chromosome (**linked**)

-Chromosomes assort independently

**- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** = location of genes on a chromosome

* + Crossovers between genes that are close are rare
  + More crossing occurs with genes that are farther apart
  + Researchers looked at data to determine location of genes