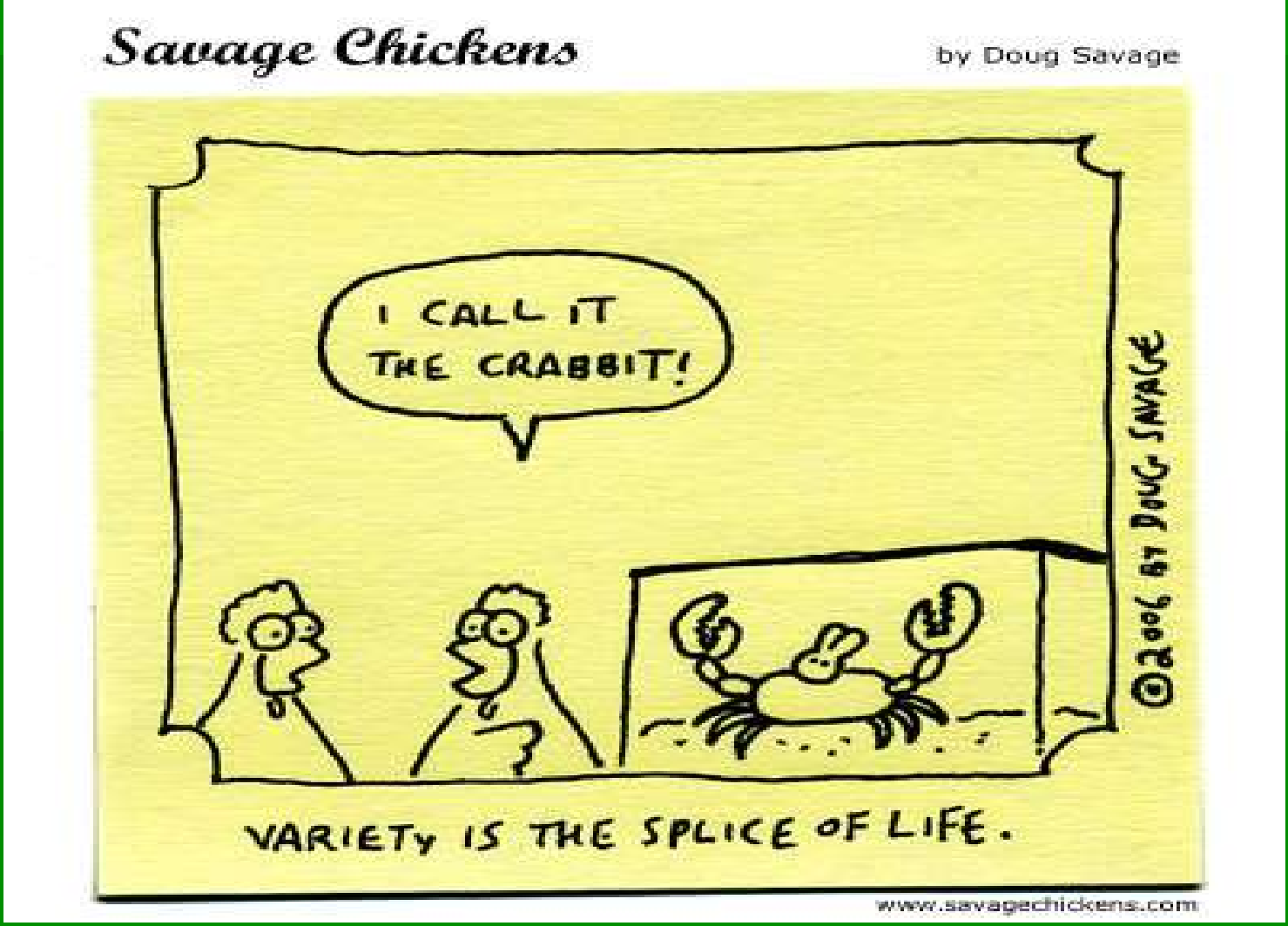
# What is Genetics?



# Lesson Objectives & Standards

**Objectives**

**Students will learn …..**

- How traits are inherited
- Mendel's role in the history of genetics
- How to use a Punnett Square to predict the crosses
- The difference between phenotype and genotype

**Standards**

**Life Sciences – Biology**

**Reproduction and Heredity**

**7- Recognize that every organism requires a set of instructions that specifies traits. These instructions are stored in the organism's chromosomes. Heredity is the passage of these instructions from one generation to another.**

**8- Recognize that hereditary information is contained in genes located in the chromosomes of each cell. A human cell contains about 30,000 different genes on 23**

# What Have You Inherited?

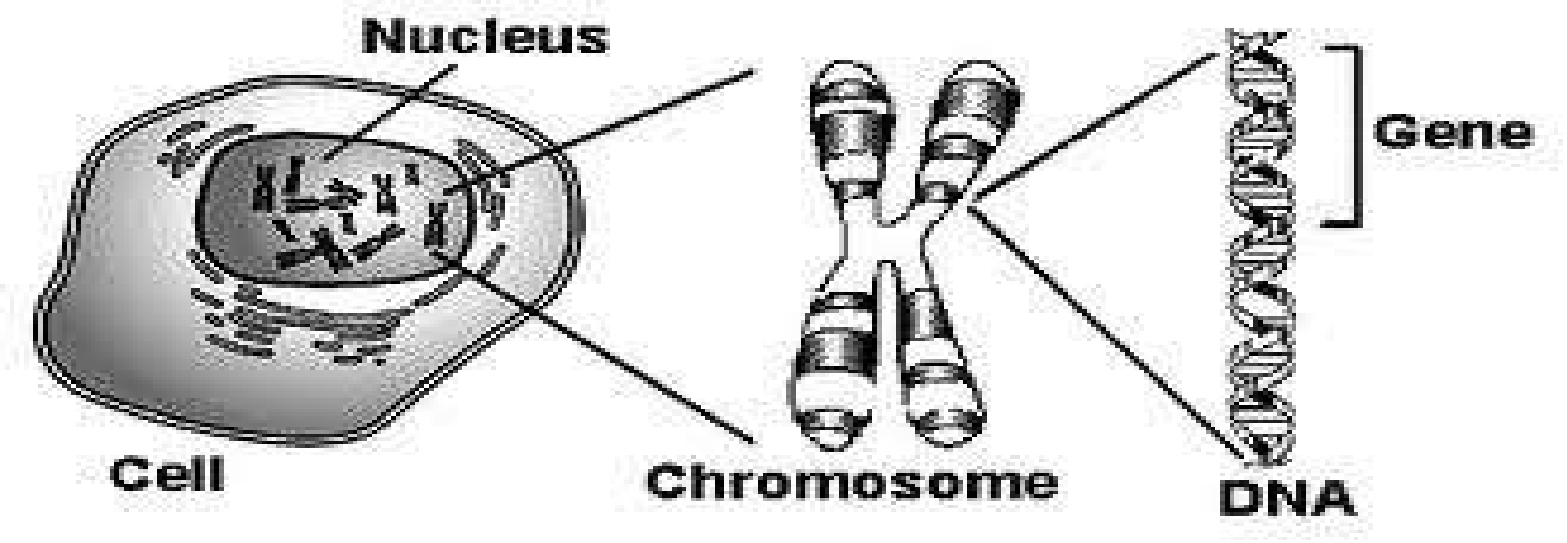
- Every organism has a collection of traits that are inherited from their parents
- Eye color, nose shape, and many other physical features are types of traits that you inherited from your parents

# Heredity

- The passing of traits from parent to offspring


# How Traits are Inherited

- Genes are made up of DNA and are located on chromosomes




- Genes control the traits that show up in an organism

# The Science of Genetics

- The study of how traits are inherited through the actions of alleles

# Alleles

- The different forms a gene may have for a trait are it alleles
- When pairs of chromosomes separate into sex cells during meiosis, pairs of genes also separate from one another
- As a result, each sex cell winds up with one allele for each trait that an organism allows

- The allele in one sex cell may control one form of the trait, such as a widows peak.

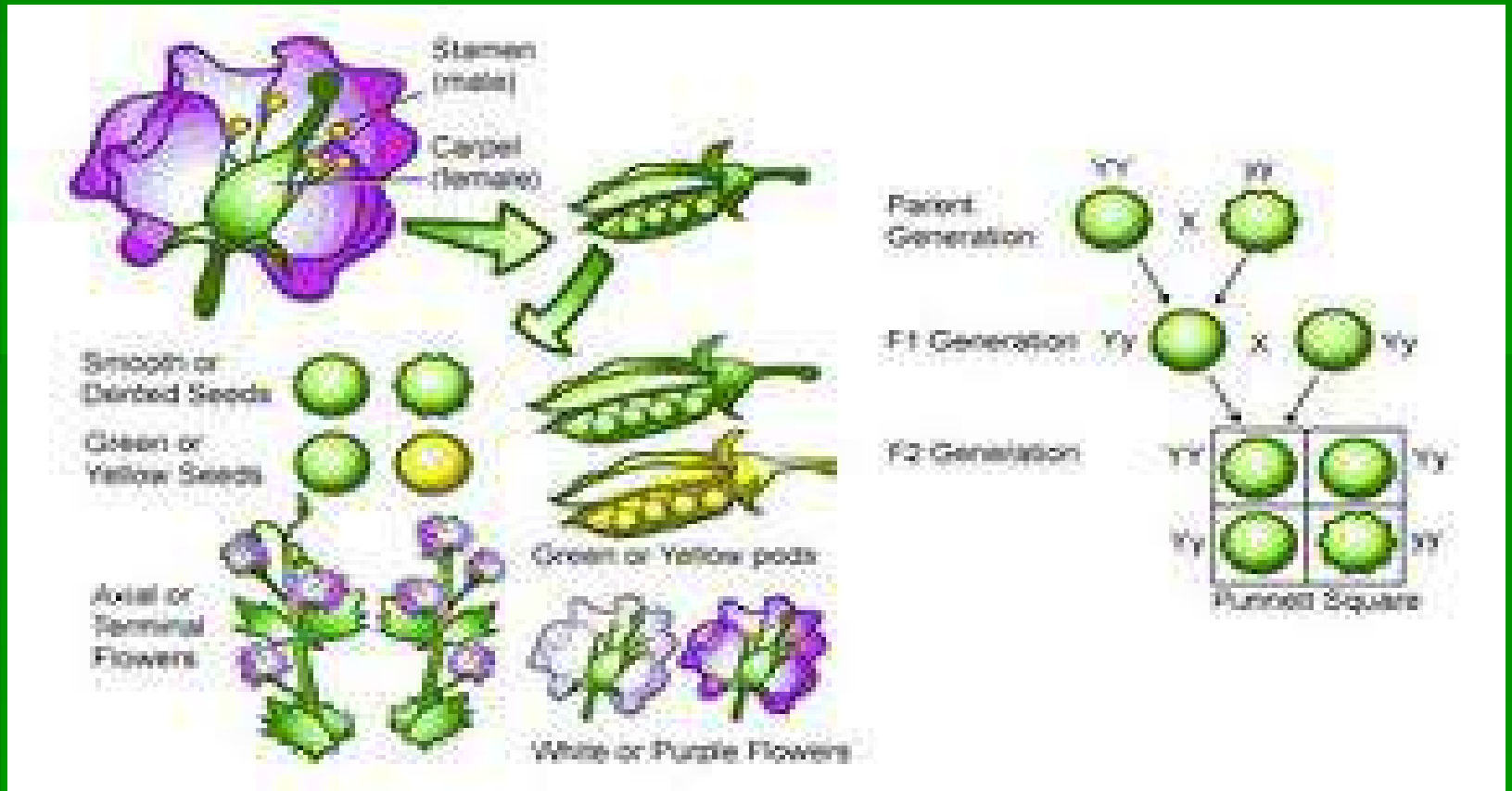
- The allele in the other sex cell may control an alternate form of the trait, such as a straight hair line

# The Father of Genetics

- Conducted the first recorded scientific study of how traits are passed from one generation to the next
- Was an Australian monk born in 1822
- Studied math and science and eventually became a teacher and priest
- 1856, he began experimenting with peas and observing plants

# Mendel's Observations

- He thought it was possible to predict the kinds of flowers and fruit a plant would produce
- But, something had to be known about the parents before such a prediction could be made



# Mendel's Research

- Made careful use of scientific methods
- Presented a paper to the Natural History Society in Austria – published in 1866 under the title "Experiments with Plant Hybrids"
- In the 1900's three other scientists working in botany rediscovered Mendel's work and had come to the same conclusion
- Since Mendel has been the known as the Father of Genetics


- Worked with ordinary peas- like the ones you eat for dinner

* easy to breed for pure traits

- An organism that always produces the same traits generation after generation is called a purebred

*Tall plants that always produce tall plants are purebred for the trait tallness

*Short plants that always have short offspring are purebred for the trait of shortness

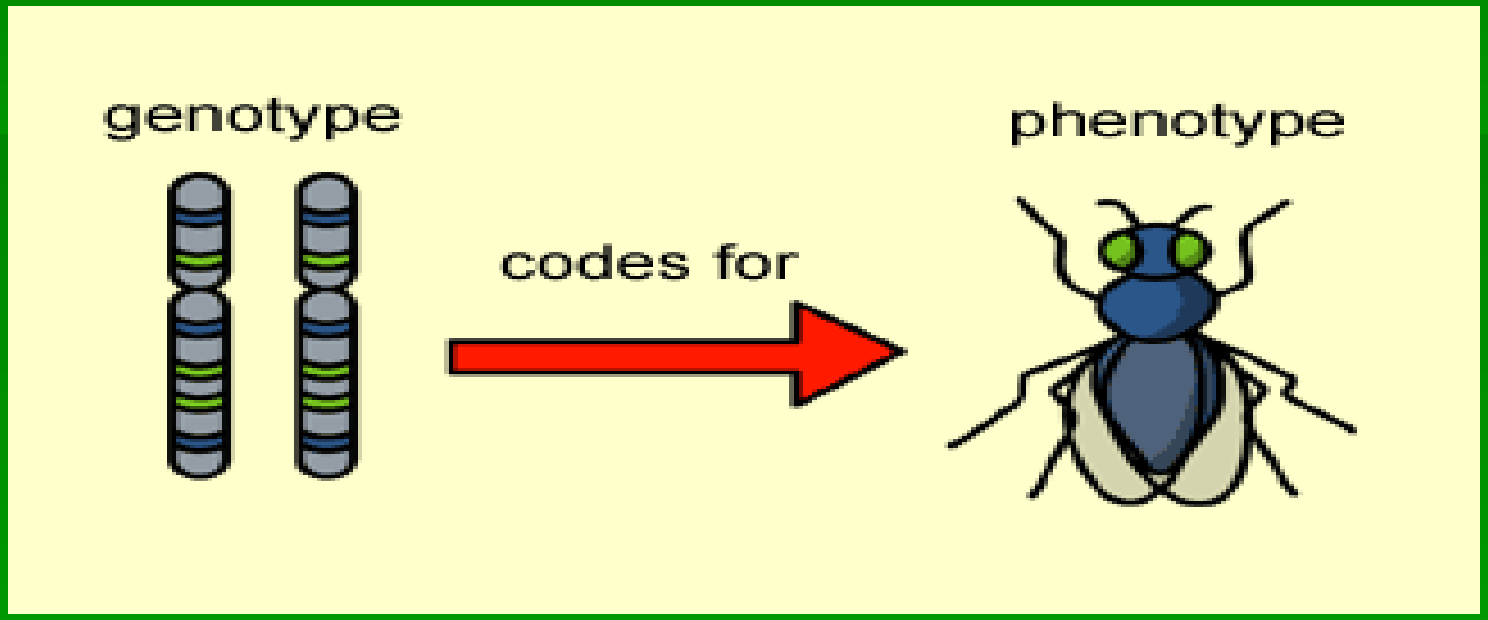
# Dominant & Recessive Factors

- →Mendel took pollen from the male reproductive structures of flowers from purebred tall plants
  →then he placed the pollen on the female reproductive structures of the flower s from pure short plants
  → the results showed what ever had caused the plants to be short had disappeared

# Dominant vs. Recessive

- Dominant – describes a trait that covers up, or dominates, another form of the trait
- Recessive- Describes a trait that is covered up, or dominated, by another form of the trait

# Genotype & Phenotype




- Genetic of an organism make-up
- Physical expression of a particular genotype

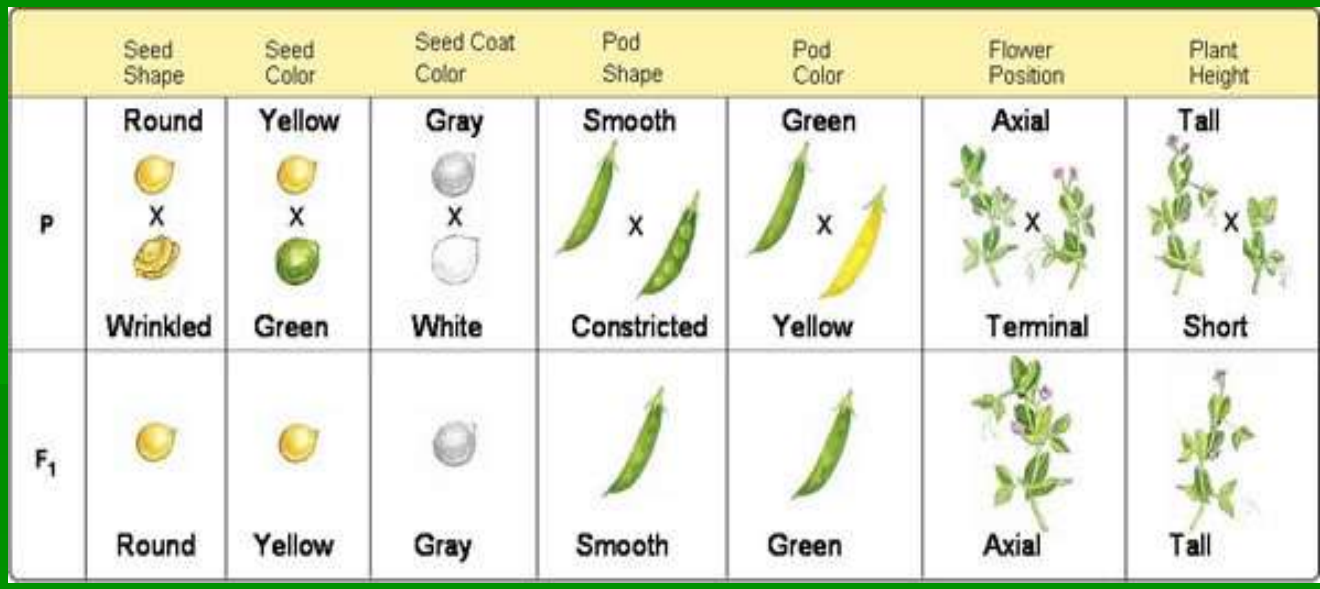
# Alleles Determine Traits

- Most cells in you body have two alleles for a trait
- An organism with two different alleles is called heterozygous

*Ex- Tt

- An organism with two alleles that are exactly the same is called homozygous

*Ex- TT or tt



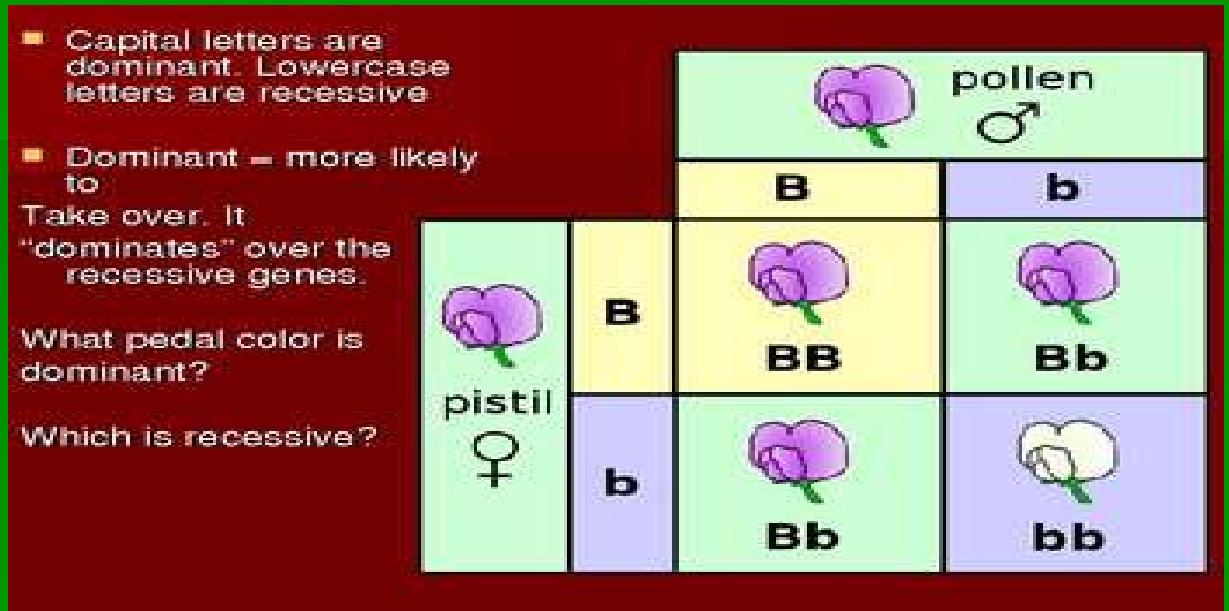

Mendel's pure bred peas were (TT), homozygous for tall and (tt) homozygous for short . The plants he produced were all heterozygous (Tt) and tall

# Predictions Using Probability

- Probability is a branch of mathematics that helps you predict the chance that something will happen
- One of the things that made Mendel's predictions accurate was that he was dealing with large numbers
- He raised and studied almost 30,000 pea plants of 8 yrs.
- In doing so he increased the chances of seeing a repeatable pattern
- Valid scientific conclusions need to be based on repeatable results

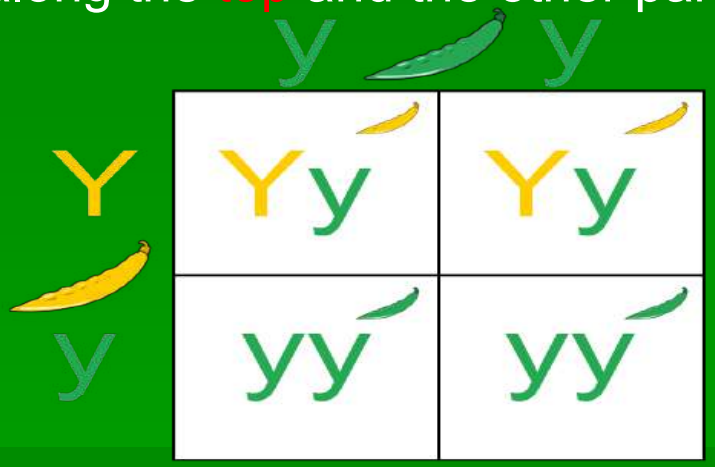
# Punnett Squares

- How could you predict what the offspring would look like without actually making cross?
- The Punnett square is a handy tool used to predict results in Mendelian genetics
- In a Punnett square, dominant and recessive are represented by letters
- Capital for dominant (T) and lower case for recessive (t)
- The letters show the genotype, or genetic make up of an organism



# Determining Genotypes and Phenotypes

- In a Punnett square, the two letters representing the two alleles from one parent are written along the top and the other parents along the side of the square




- Each section of the square is filled in like a multiplication table – with one allele donated by each parent
- The letters that you use to fill in each of the squares represent the genotypes and phenotypes of offspring that the parents could produce

# Mendelian Rules of Inheritance

1- Traits are controlled by alleles on chromosomes

2- An allele may be dominant or recessive in form

3- When a pair of chromosomes separates during meiosis, the different alleles for a trait move into separate sex cells