

# Lab 3

Genetics the Basics



# What is Genetics???

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- Genetics is the scientific study of heredity.
- Heredity is what makes each species unique.

# Review

- What is the process that makes somatic cells?
- What is the process that makes gametes?
- How many chromosomes in a somatic cell?
- How many in a gamete?

# Review

- What is the process that makes somatic cells? **mitosis**
- What is the process that makes gametes? **meiosis**
- How many chromosomes in a somatic cell? **46**
- How many in a gamete? **23**

# MENDELIAN GENETICS

- Genetics was unknown in Darwin's time
- Gregor Mendel bred pea plants and discovered the laws of inheritance
- He was successful partly because the traits he observed were **simple traits**, controlled by only one gene
- These are now called **Mendelian traits**
  - Examples: black fur or white fur
  - Right-handed or left-handed

# MENDELIAL GENETICS

- Mendel's laws of inheritance:
- **1. Principle of Segregation:** chromosomes inherited from mom and dad stay separated
- **2. Principle of Independent Assortment:** you have an equal chance of inheriting each gene from each parent

[https://www.youtube.com/watch?  
v=CBezq1fFUEA](https://www.youtube.com/watch?v=CBezq1fFUEA)

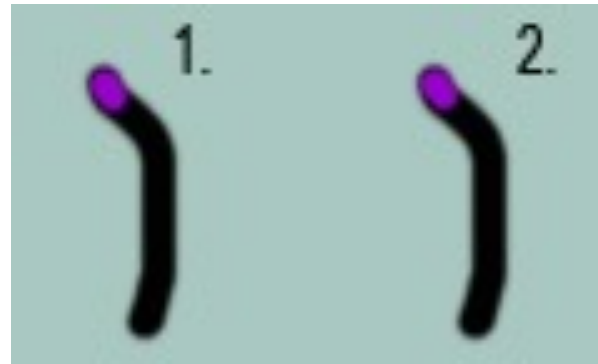
# MENDELIAL GENETICS

- A **gene** is a segment of a chromosome's DNA that codes for specific functions or traits
- **Genotype** is the 2 alleles at a given locus. They are represented by letters. (ex. Aa or AA)
- If an individual inherits two alleles that code for the same form of a trait they are **homozygous**. If they have different forms they are **heterozygous**.

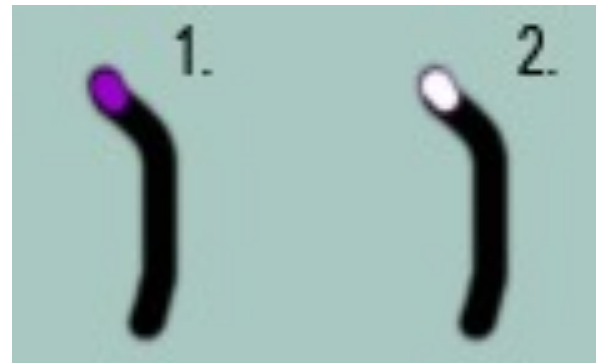


# Homozygous vs. Heterozygous Genotypes

- **Homozygous:** the same allele at the same locus on both versions of the chromosome



- **Heterozygous:** a different allele at a particular locus on each chromosome

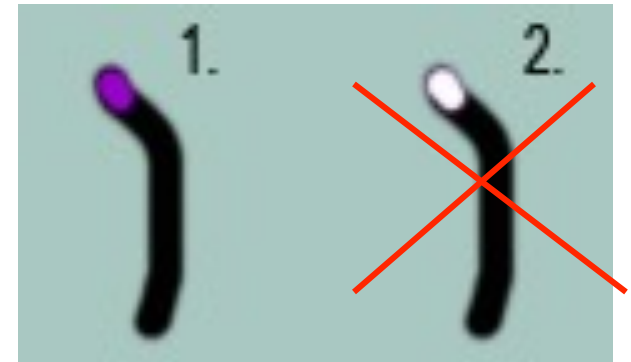


# MENDELIAL GENETICS

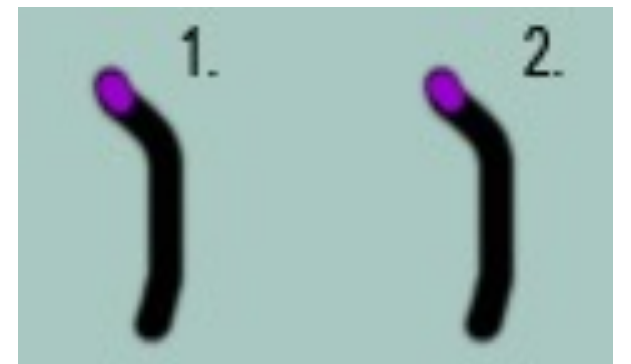
- If an allele is always expressed when present, it is **dominant**. If it is masked, it is **recessive**. The only time recessive traits are expressed is if they are both recessive, or **homozygous recessive**.
- **Homozygous dominant**: 2 dominant forms (AA)
- **Homozygous recessive**: 2 recessive forms (aa)
- **Heterozygous**: one of each (Aa)
- Dominant does not mean better, healthier, or more common

# Dominant & recessive alleles

- 2 different alleles  
(**heterozygous**) = Aa
- Sometimes one of the alleles “overrides” the effects of other: this is called **dominance** = **A > a**
- A **dominant** allele overrides the effects of a **recessive** allele

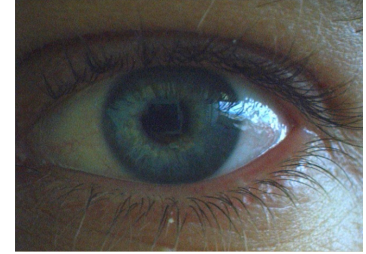
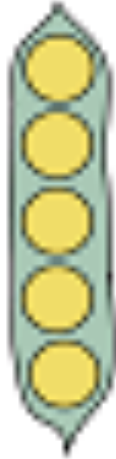


Aa



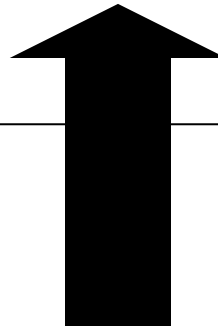
AA or aa

# Genotype / Phenotype



**Phenotype:** observable traits

The proteins that are built using the recipe.



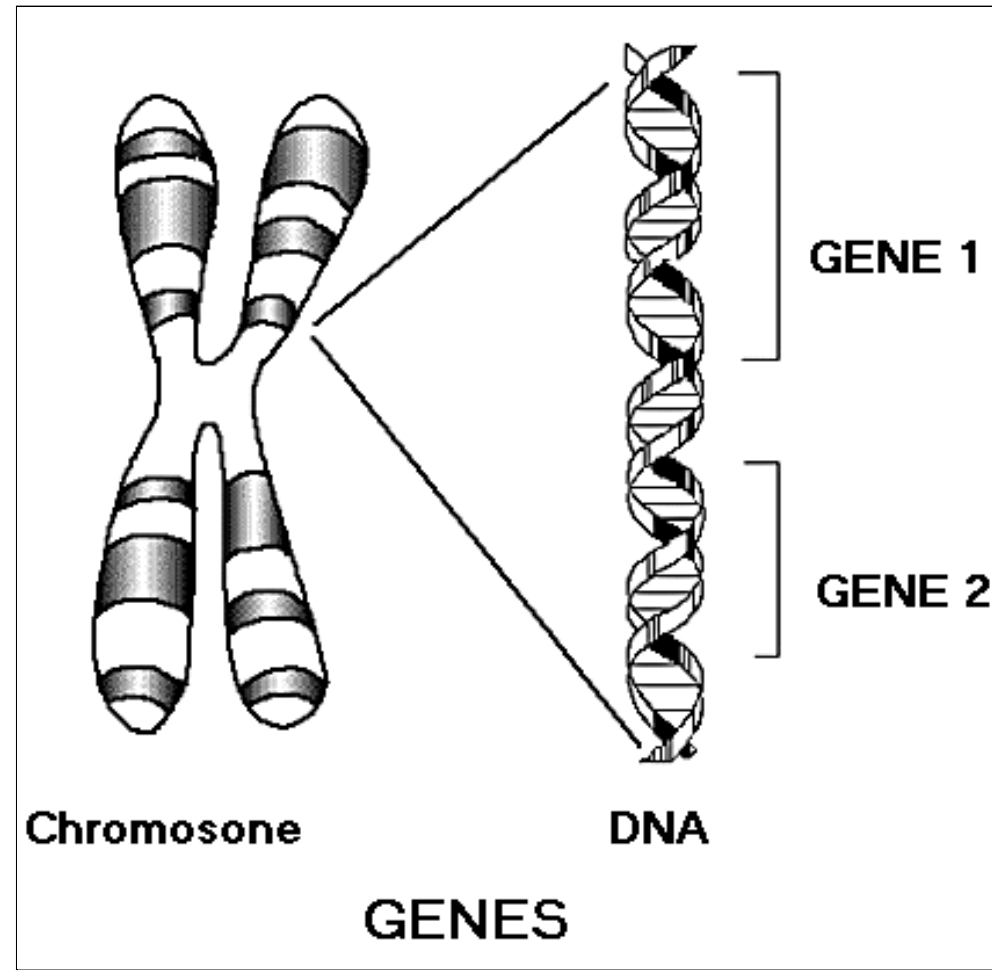
**Genotype:** the alleles you carry

The recipe in your DNA.



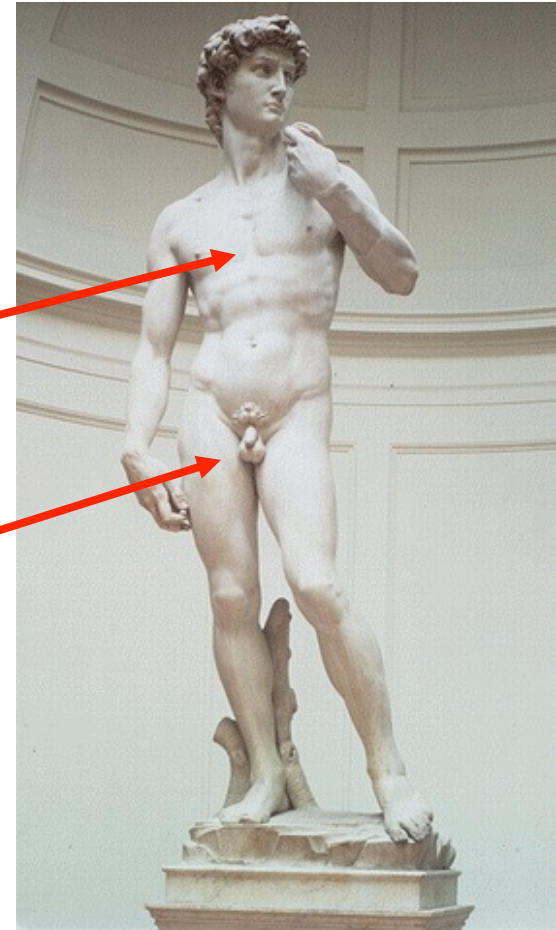
# Genes are segments on chromosomes

- Genes on chromosomes like beads on a string
- Each gene has a specific location = **locus**
  - **Gene loci**
- There can be different *versions* of the same kind of gene: these are called **alleles**
- Homologous alleles work together to produce phenotype

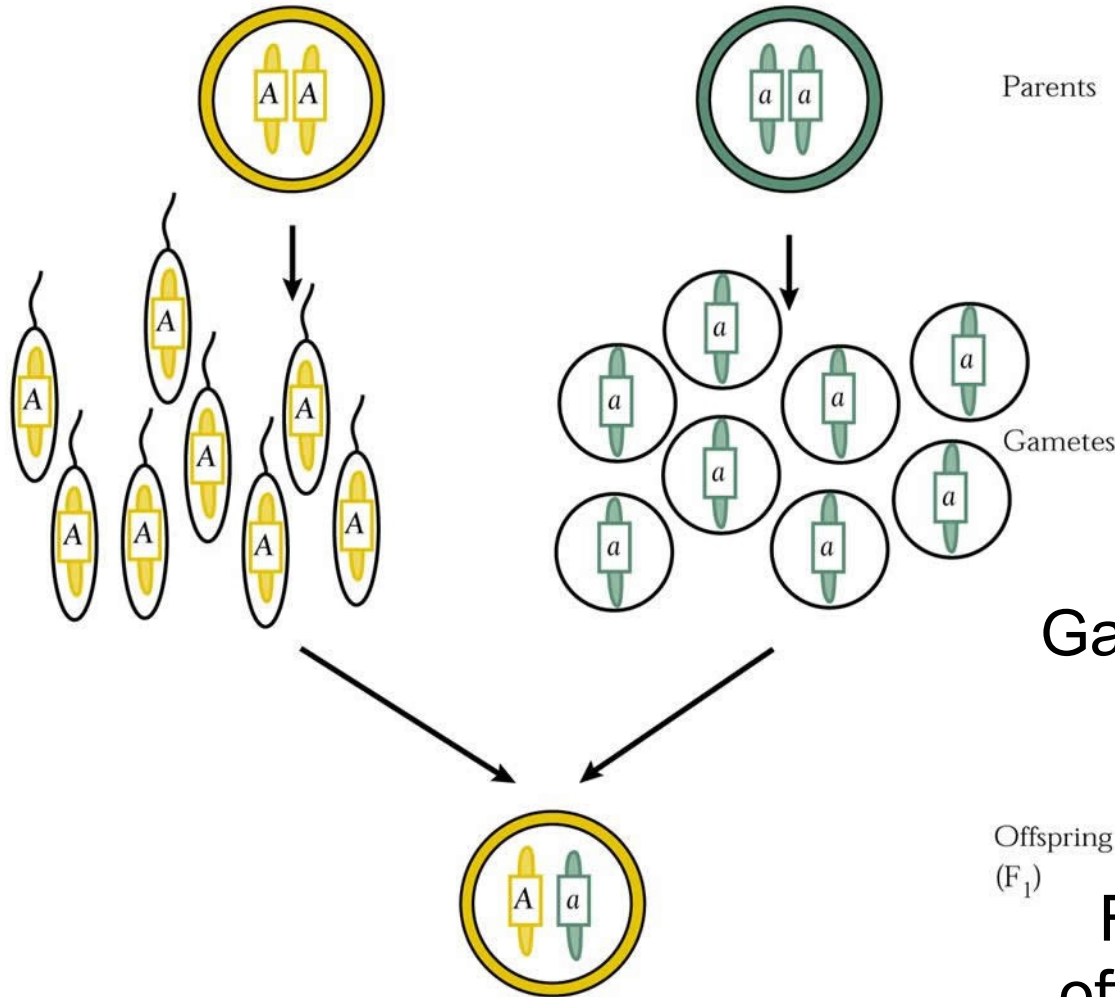


# Cell Division: Sharing the recipe

- DNA replicates before cell division
  - Two types of replication:
- **Mitosis:** makes a new somatic (body) cell
- **Meiosis:** makes gametes (sex cells, sperm and eggs) used in sexual reproduction



# To make a new organism



Parents

Parents make **gametes**

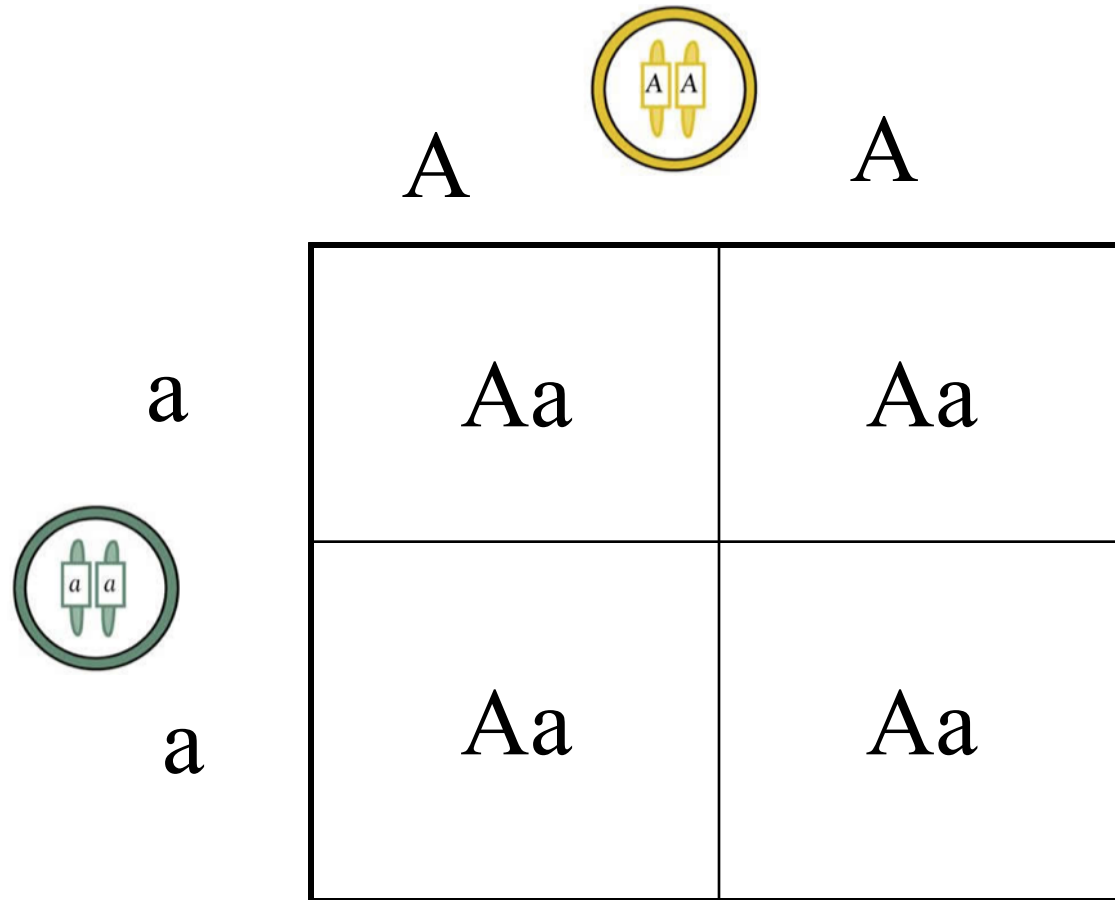
Gametes

Gametes from two parents  
fuse to form offspring

Offspring  
(F<sub>1</sub>)

For each chromosome,  
offspring carry two copies:  
one from each parent

# Punnett Square Method



Genotypes

- 4 Aa

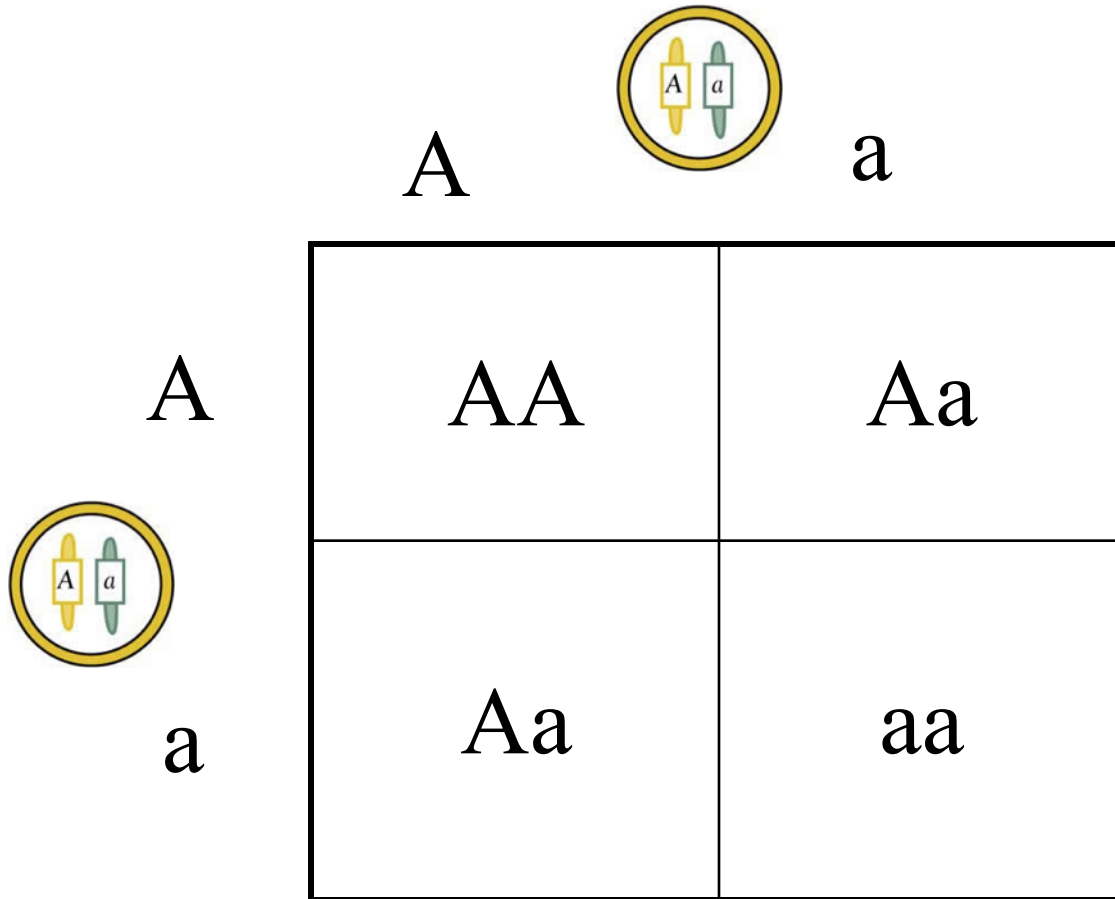
Phenotypes

- 4 Yellow



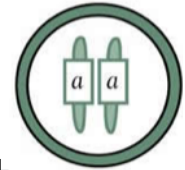


# Punnett Square Method



## Genotypes

- 1 AA
- 2 Aa
- 1 aa



## Phenotypes

- 3 Yellow
- 1 Green

# SEX-LINKED TRAITS

- Sex-linked traits can be on X or Y chromosome
- Most are X-linked
- An example is red/green colorblindness. Most are males because this trait is transmitted by a recessive gene on the X chromosome
- A female has a better chance of getting a dominant X that will mask the gene, but males only have 1 X, so the trait will show
- Males are **hemizygous**

# Lab 3

- Do exercise 3.1 (first, second and first 3 of the third box) Finish pages 32-33
- Exercise 3.2.5
- Exercise 3.4