

### Lab 5. Overview

- **Collect Lab. Exercises and Check Pre-Labs. in Lab Notebook**
- **Discussion of Exercises**
  - Graphing
  - Hypothesis Testing
- **Basic Genetics.**
- **Microevolutionary Processes.**
- **Today's Activities**

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### Genetics Overview

- Genes (DNA) in cells direct cell activities.
- Most cells have TWO copies of every kind of gene. (DIPLOID)
- One copy from each parent.
- Sperm or egg have ONE copy of every gene. (HAPLOID)

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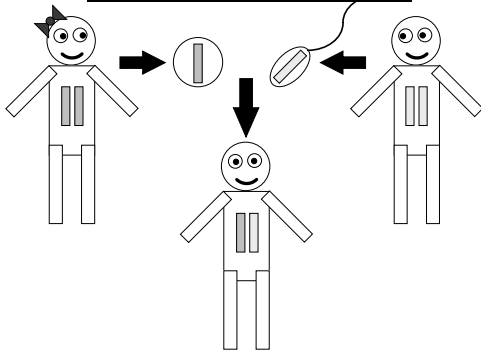
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### Genetics Overview



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## Genetics Overview

- The same gene can have different forms (**Alleles**).  
E.g., blue iris allele and brown iris allele of eye color gene
- Diploid individual with the same 2 alleles = **homozygote**.
- Diploid individual with 2 different alleles = **heterozygote**.

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## Genetics Overview

- **Dominant alleles**, when present, affect the physical characteristics of the organism (phenotype) in homozygous or heterozygous individuals.



- **Recessive alleles**, when present, affect the physical characteristics of the organism (phenotype) ONLY in homozygous individuals.



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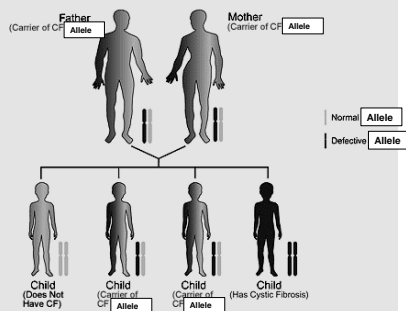
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## Inheritance

### Inheritance of Cystic Fibrosis (CF)



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



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## Genetic Abbreviations

- Gene “A” has 2 alleles,   
“A” (dominant allele) and “a” (recessive allele)
- AA or aa = homozygotes.  
- Aa = heterozygotes. 
- AA, Aa, and aa = genotypes.  
  

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## Genotype & Allele Frequencies

- **Genotype Frequency** = the percent of a diploid combination of **alleles** (in decimal format) among all individuals in a population. (What percent of individuals in this population has this genotype?)
- **Allele Frequency** = the percent of a single **allele** (in decimal format) among all alleles for a single gene in a population. (What percent of the total number of alleles in this population has this allele?)

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## Calculating Genotype Frequency

In this population of 200 individuals:

**50 AA, 90 Aa, 60 aa**

$$AA = 50 \div 200 = 0.25$$

$$Aa = 90 \div 200 = 0.45$$

$$aa = 60 \div 200 = 0.30$$

In a population of 500 individuals:

**200 AA, 250 Aa, 50 aa**

what are the genotype frequencies?

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### **Calculating Allele Frequency**

In a population of 200 individuals with the genotypes **100 AA, 80 Aa, 20 aa** , what are the allele frequencies?

**STEP 1** - How many alleles are there?  
200 individuals x 2 alleles = 400 alleles in the pop.

**STEP 2** - How many of each allele in pop.?

$$\#A = 80 \text{ in } Aa + (2 \times 100 \text{ AA}) = 280$$

$$\#a = 80 \text{ in } Aa + (2 \times 20 \text{ aa}) = 120$$

**STEP 3** – What are the allele freqs.?

$$\text{Freq. of } A = 280 / 400 = 0.70$$

$$\text{Freq. of } a = 120 / 400 = 0.30$$

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### **Microevolutionary Processes**

- **Mutation** = introduction of random genetic variation (new alleles). Change in the DNA (in a sex cell).
- **Genetic Drift** = change in the genotype or allele frequencies of a (small) population due to chance.
- **Natural Selection** = differential reproduction (survival) due to the effect of different individual genotypes in a particular environment.

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### **Microevolutionary Processes**

- **Non-Random Mating**
  - Inbreeding** = breeding more commonly with related individuals increases homozygosity
  - Outbreeding** = breeding more commonly with unrelated individuals increases heterozygosity
- **Gene Flow** = change in genotype or allele frequencies in a population due to movement of individuals or gametes between populations

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### Simulation Reminders

- Remember you are a hermaphrodite in this simulation. (Lucky you.)
- You and a partner create two offspring, “die,” and then become the offspring. You will always have only one genotype.
- Don't be lazy. Move around to mate randomly.
- You only need to flip the coin to determine which allele to give if you are heterozygous.

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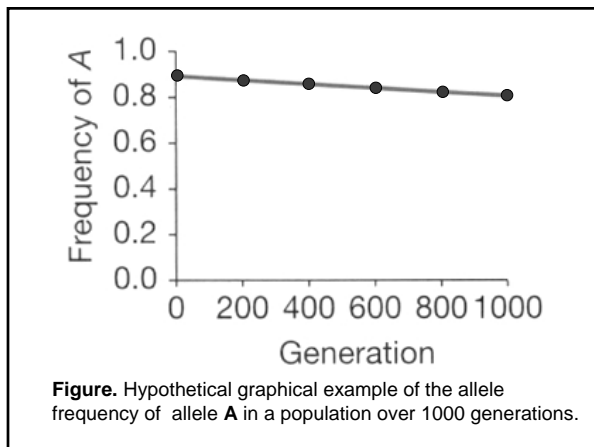
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### Plant Culturing

- Mouse-Ear Cress, *Arabidopsis thaliana*
- Marigold, *Tagetes patula*
- C-Fern, *Ceratopteris* sp.



For culturing *Ceratopteris* spores be certain to maintain a sterile work environment. Fungal spore contamination can be a problem.

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