

## TOPIC: GENETICS AND ALLELE FREQUENCIES

### Mendelian and Population Genetics

◆ *Mendelian* genetics tracks how alleles are inherited in \_\_\_\_\_ matings (in *diploid* organisms).

**Phenotype:** an organism's traits → from genetics & environment.

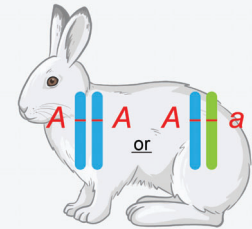
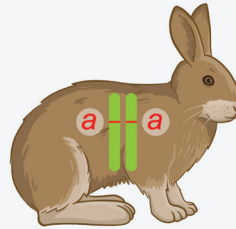
**Gene:** a section of \_\_\_\_\_ that codes for a trait.

**Allele:** the different versions of a \_\_\_\_\_ gene.

**Genotype:** an organism's specific \_\_\_\_\_ of alleles.

- **Homozygous:** 2 copies of the \_\_\_\_\_ allele.

- **Heterozygous:** having 2 \_\_\_\_\_ alleles.

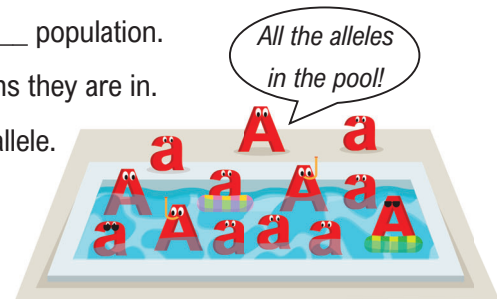


◆ *Population* genetics tracks how alleles are inherited in the \_\_\_\_\_ population.

▪ **Gene Pool:** all alleles in the population \_\_\_\_\_ of organisms they are in.

▪ **Allele Frequency:** the \_\_\_\_\_ of gene pool made up of one allele.

- Change in allele frequency is our measure of \_\_\_\_\_.



## EXAMPLE

The number of alleles in two different gene pools are shown below. Answer the following:

### Gene Pool 1:

400 A alleles

600 a alleles

### Gene Pool 2:

5000 A alleles

5000 a alleles

a) Which population has a higher frequency of the a allele? \_\_\_\_\_

b) Based on these allele frequencies, can you tell which population has a higher frequency of heterozygotes? Why or why not? \_\_\_\_\_

\_\_\_\_\_

## **TOPIC: GENETICS AND ALLELE FREQUENCIES**

### **PRACTICE**

When all the alleles in a population are considered together, independently of the individuals they come from, we call that the \_\_\_\_\_.

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- a) Genotype.
- b) Gene pool.
- c) Phenotype.
- d) Mendelian genetics.

### **PRACTICE**

Which of the following terms is correctly matched to its definition?

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- a) Allele: an organism's traits.
- b) Phenotype: an organism's specific set of alleles.
- c) Heterozygote: having two copies of the same allele.
- d) Genotype: an organism's specific set of alleles.

## TOPIC: GENETICS AND ALLELE FREQUENCIES

### Allele Frequencies

- ◆ Allele frequency: divide the number of a \_\_\_\_\_ allele by the number of \_\_\_\_\_ alleles.
  - $p$  = the frequency of the \_\_\_\_\_ allele ( $A$ ).     $q$  = the frequency of the \_\_\_\_\_ allele ( $a$ ).
  - Because there are only 2 alleles:  $p + q = \underline{\hspace{1cm}}$ .

A sample from a population has:

AA: 100      Aa: 250      aa: 150

1.  $\#A = 2(\underline{\hspace{1cm}}) + \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$      $\#a = \underline{\hspace{1cm}} + 2(\underline{\hspace{1cm}}) = \underline{\hspace{1cm}}$

2. Total alleles =  $2(\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}}) = \underline{\hspace{1cm}}$

3.  $p = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$        $q = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

#### Steps to calculate allele frequency:

1. Count total  $A$  and  $a$  alleles:  
 $\#A$  alleles =  $2(\#AA) + \#Aa$   
 $\#a$  alleles =  $\#Aa + 2(\#aa)$
2. Calculate total # alleles in population.  
Total alleles =  $2(\#\text{individuals})$
3. Calculate allele frequency:

$$p = \frac{\#A \text{ alleles}}{\text{Total alleles}} \quad q = \frac{\#a \text{ alleles}}{\text{Total alleles}}$$

- ◆ If there is only 1 allele in the population ( $p$  or  $q = 1$ ), that allele is \_\_\_\_\_.

### PRACTICE

The number of individuals in a population with each of the following genotypes is listed below. What is the frequency of the small  $t$  allele?

**$TT$ : 640**

**$Tt$ : 200**

**$tt$ : 160**

- a) 0.32      b) 0.16      c) 0.26      d) 0.52

## **TOPIC: GENETICS AND ALLELE FREQUENCIES**

### **PRACTICE**

Gia and Kojo collect a sample of beetles to calculate the frequency for the  $W$  allele. After genotyping the individuals in their sample, they count the following genotypes:

**$WW$ : 50       $Ww$ : 170       $ww$ : 120**

Gia calculates the frequency by taking:  $W = \frac{50 + 50 + 170}{680}$

Kojo calculates the frequency by taking:  $W = \frac{2(50) + 170}{50 + 170 + 120}$

Who calculated the frequency incorrectly, and what was their mistake?

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- a) Kojo because he divided by the number of individuals instead of total alleles.
- b) Kojo because he multiplied the number of homozygotes by 2 but not the number of heterozygotes.
- c) Gia because she added instead of multiplying the number of  $W$  alleles found in the homozygote.
- d) Gia because she did not multiply the total number of individuals by 2.