# Genetics and Allele Frequencies

1) Fill in the blanks using the word bank below after watching the *Amoeba Sisters* video on alleles and genes.

   A. _____ → Segment of DNA that codes for a particular trait (e.g. eye color)

   B. _____ → Alternate form or version of a gene (e.g. blue vs. brown)

   C. _____ → Two copies of the same allele

   D. _____ → A copy of two different alleles

   E. _____ → Allele that over-rides the other

   F. _____ → Allele that is not expressed (masked by the other)

   G. _____ → The combination of alleles an individual has in its genes (e.g. Bb or bb)

   H. _____ → The actual physical trait that is expressed in the organism

   | Genotype | Heterozygous | Gene | Allele |
   |---|---|---|---|
   | Phenotype | Dominant | Recessive | Homozygous |

2) Let's use the letter F to represent the "number of fingers" gene.  There are two different alleles for this gene.  Having six fingers, called *polydactyly*, is actually dominant (F) to having five fingers (f).  Based on this example:

   A. Fill in the following chart for number of fingers:

   |  | Genotype (allele combination) | Phenotype (how many fingers) |
   |---|---|---|
   | Homozygous dominant |  |  |
   | Heterozygous |  |  |
   | Homozygous recessive |  |  |

   B. Record your own genotype for this trait: _____

   C. How can you say know this is your genotype without having some sort of genetic test?

   D. Does an allele's dominance mean that it's more common in a population?

   E. Complete a Punnett square for a normal 5-fingered person who has a child with a mate who is *homozygous dominant* for this gene:

   F. What is the **genotypic ratio** for these offspring?

   G. What is the **phenotypic ratio** for these offspring?

3) Let's use the letter H to represent what type of hair you have: Curly or straight. In general, curly hair (H) is dominant to straight hair (h). Of course, there are more types of hair than just curly or straight, but let's simplify!

   A. Complete the following chart:

| | Genotype (allele combination) | Phenotype (type of hair) |
|---|---|---|
| Homozygous dominant | | |
| Heterozygous | | |
| Homozygous recessive | | |

   B. Complete a Punnett square for a mother with straight hair and a father who is *heterozygous* for curly hair (Hh):

   C. What is the **genotypic ratio** for these offspring?

   D. What is the **phenotypic ratio** for these offspring?

   E. What is the physical difference in hair between the father (Hh) and his brother who is *homozygous dominant* for this hair gene?

   F. Let's say a bizarre group of curly-haired aliens comes down to Earth and decides that they are going to decimate the human race by attacking only straight-haired people. Based on this scenario, does natural selection act directly on an organism's <u>genotype or phenotype</u>? **WHY?**

4) Look at the pie chart on the right that shows the genetic makeup of a population in one science class.

   A. How many students are there total? _____
   B. How many students have straight hair? _____
   C. How many students have curly hair? _____
   D. How many curly hair alleles are there total? _____
   E. How many straight hair alleles? _____
   F. How many alleles are there total? _____
   G. What is the allele frequency for straight hair?
   (To get this number, divide the number of straight-haired alleles by the total number of alleles.)

   5 curly hair (homozygous)

   12 curly hair (heterozygous)

   8 straight hair (homozygous)
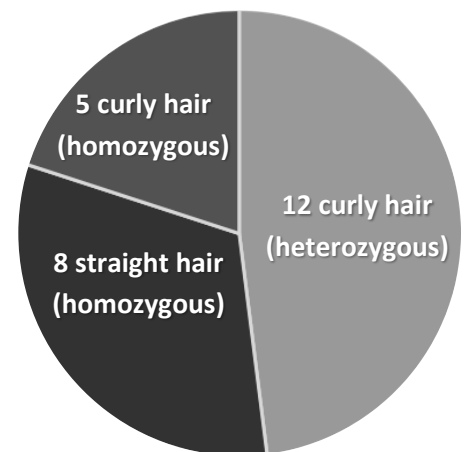
   H. What is likely to happen to this allele frequency in this class if the aliens keep up with their nefarious plan to wipe us out?