**Math, Genes, and You**

Week 1, Day 2: Basic Principles of Genetic Inheritance

**Plan for today**

Genetics news

Class activity: Finish the inventory of traits

Lecture: Basic principles of genetic inheritance

Class activity: Pick a random number

Class activity: Breeding experiment

**Class rules**

Updated and posted on the course page: <https://www.openlearning.com/beam/courses/bdut-am-greg/homepage/>

**Definitions**

**Cell** – Basic biological unit and building block of all life

**DNA** – The genetic material in each cell that is passed down from parents to offspring. Exists in in long molecules (called chromosomes) as a double-stranded helix.

**Base** – One of four chemicals that form the DNA sequence, represented by the letters A, C, G, T

**Variant** – A specific place in the DNA sequence where two individuals can differ. For example:

|  |  |
| --- | --- |
| Individual 1: | -T-G-A-G-G-**A**-T-T-T-T- |
|  | -T-G-A-G-G-**A**-T-T-T-T- |
|  |  |
| Individual 2: | -T-G-A-G-G-**A**-T-T-T-T- |
|  | -T-G-A-G-G-**C**-T-T-T-T- |

**Allele** – One of the possible sequences an individual can have at a variant site. In the above example, the two alleles and A and C.

**Genotype** – The alleles that an individual has at a variant. In the above example, the genotypes are AA and AC.

**Examples**

Example 1: Punnett square of an AA-AB cross

|  |  |  |
| --- | --- | --- |
|  | **A** | **A** |
| **A** | AA | AA |
| **B** | AB | AB |

From this, we expect ½ of the offspring to be AA, and ½ to be AB.

Example 2: Punnett square of an AB-AB cross

|  |  |  |
| --- | --- | --- |
|  | **A** | **B** |
| **A** | AA | AB |
| **B** | AB | BB |

From this, we expect ¼ of the offspring to be AA, ½ to be AB, and ¼ to be BB.

**Breeding Experiment**

* Have a piece of paper ready
* Use <https://justflipacoin.com>
* Flip once to get your first allele, H or T. Write it down.
* Flip again to get your second allele, H or T. Write it down.
* Your two alleles form your genotype HH, HT, or TT. (HT and TH are considered equivalent.)
* You will be randomly paired with another student.
  + Each of you will flip to determine which of your two alleles will be passed on to your offspring.
  + If you get an H, you pass on your first allele. If a T, you pass on your second allele.
  + Write down the resulting genotype of your offspring individual.

**Problem set 1:**

Submit your answers to Open Learning: <https://www.openlearning.com/beam/courses/bdut-am-greg/week_1_day_2_problem_set_1_submission/>

1. What are the possible genotypes and expected frequencies of a cross between an AB and a BB individual?
2. Consider a variant with three alleles, A, B, and C. If an AB and an AC individual were to cross, what would be the possible genotypes and their expected frequencies?
3. Cross an AA and a BB individual. What will be the resulting genotypes of the offspring? If two of them were to mate, what would be the possible genotypes and their expected frequencies?