**Alien Genetics for High Schoolers**

1. Coin flip to determine own features (Heads = Dominant; Tails = Recessive) \*Include PTC tasting
	1. Hand out “Parent” sheet
	2. Flip a coin for each trait to determine genotype
2. Pair up and complete a Punnett Square for each of the features using info from both partners
	1. Use all 4/16 alleles (2/8 from each “Parent”) to fill in the Punnett Square
	2. **To determine both your baby’s sex and wing-type, use the Punnett Square you created for #6.**
3. Use a spinner (manual or Google) to determine the genotype and phenotype for the genes of your offspring.
	1. The numbers on the spinner correspond to an individual square on the Punnett Square
		1. The numbers start in the top left and go left -> right, top -> bottom

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 |

|  |  |
| --- | --- |
| 1 | 2 |
| 3 | 4 |

1. Create your offspring using the materials provided.

**YOUR TRAITS (STEP 1)**

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| **Heads = Dominant; Tails = Recessive** | **Genotype** | **Phenotype** |
| 1. **\*\***Sex (Assign 1 partner XX (Female) and 1 partner XY (Male)) (you will not create a Punnett Square for this item)
 |  |  |
| 1. Eyes (Both eyes same color (MM, Mm) or each eye a different color (heterochromia) (mm)); you choose your eye color(s) and write under Phenotype
 |  |  |
| 1. Ears (Wiggle (W) or No Wiggle (w))
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| 1. Body Hair (Hairy (H) or Bald (h))
 |  |  |
| 1. Height (Digenic, 4 alleles (J, j, Z, z) Short (Dominant), Tall (Recessive), Medium (Hybrid)); you can choose to use your real-life height to create your genotype or flip a coin 4 times)
 |  |  |
| 1. Wings (Sex-linked to X chromosome (Feathery (F) or No feathers (f)); If your sex genotype is XY, you will only flip the coin 1x. If XX, flip the coin 2x
 |  |  |
| 1. Fire (Non-Mendelian incomplete dominance, Blue (B) (Dominant), Red (b) (Recessive), purple (Hybrid))
 |  |  |
| 1. Teeth (Retractable (R) or Fixed (r))
 |  |  |
| 1. **\*\***Diet (Non-Mendelian codominance (Carnivore (C), Herbivore (H), or Omnivore (CH)); both parents will be Omnivores
 | **CH** | **Ominivore** |
| 1. Special Trait (codominant trait; choose your own special trait and a letter to represent the alleles; try to choose a letter that has not been used)
 |  |  |

**\*\*Complete these items together with your partner.**

**OFFSPRING TRAITS (STEP 3)**

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| **Characteristic** | **Genotype** | **Phenotype** |
| 1. \*\*Sex (complete with item 6, see below)
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| 1. Eyes
 |  |  |
| 1. Ears
 |  |  |
| 1. Body Hair
 |  |  |
| 1. Height (polygenic, 3 options)
 |  |  |
| 1. \*\*Wings (sex-linked) (complete with item 1)
 |  |  |
| 1. Fire (incomplete dominance, 3 options)
 |  |  |
| 1. Teeth
 |  |  |
| 1. Carnivore (codominance, 3 options)
 |  |  |
| 1. Special Trait
 |  |  |

**\*\*Do items 1 and 6 together. Using the Punnett square you created for #6, use the spinner to determine the sex of your offspring and their wing-type.**

**PARTNER PUNNET SQUARES (STEP 2)**

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**1 (See #6) 2 3 4**

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 **8 9 10**

**OPTIONAL CALCUALTIONS**

The Hardy – Weinberg Equation is a mathematical equation that can be used to calculate the genetic variation of a population at equilibrium. The equation is an expression of the principle known as Hardy-Weinberg equilibrium, which states that the amount of genetic variation in a population will remain constant from one generation to the next in the absence of disturbing factors. The Hardy-Weinberg equation is expressed as: **p2 + 2pq + q2 = 1**, where p is the frequency of the "A" allele and q is the frequency of the "a" allele in the population. In the equation, p2 represents the frequency of the homozygous genotype AA, q2 represents the frequency of the homozygous genotype aa, and 2pq represents the frequency of the heterozygous genotype Aa. In addition, the sum of the allele frequencies for all the alleles at the locus must be 1, so p + q = 1. If the p and q allele frequencies are known, then the frequencies of the three genotypes may be calculated using the Hardy-Weinberg equation. In population genetics studies, the Hardy-Weinberg equation can be used to measure whether the observed genotype frequencies in a population differ from the frequencies predicted by the equation.

**Directions:** Use items 2, 3 and 7 from the “YOUR TRAITS” chart to do your own Hardy –Weinberg calculations. Your teacher will lead you through these as a class.