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Introduction to Punnett Squares (Science 10)

***Punnett Square:*** tool used to predict the genotypes and phenotypes of offspring of a cross between two parents whose genotypes are known

***Monohybrid Cross:*** an intentional mating (cross) between two parents that only considers one trait

***Genotypic Ratio:*** expected proportions of offspring genotypes, in lowest terms (e.g. 1 rr : 2Rr : 1RR); can also be expressed as a percentage (e.g. 25% rr, 50% Rr, 25% RR)

***Phenotypic Ratio:*** expected proportions of offspring phenotypes, in lowest terms (e.g. 1 short : 3 long); can also be expressed as a percentage (e.g. 25% short, 75% long)

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**How to Draw a Punnett Square for a Monohybrid Cross**

1. Determine the genotypes of the parents.
2. Write the genotypes of the parents in the Punnett square.
3. Determine the possible genotypes of the offspring. Write the genotypic ratio.

* Note for heterozygote genotypes: write the dominant allele first. E.g. *Tt*, not *tT*.

1. Interpret the genotypes to determine the possible phenotypes of the offspring. Write the phenotypic ratio.

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| Example 1: In mice, fur colour is determined by a single gene, where brown (B) is dominant to white (b). A heterozygote is crossed with a homozygous recessive mouse. | |
| Step 1 | Heterozygote = Homozygous recessive = |
| Steps 2 + 3 | |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  |   Genotypic ratio: |
| Step 4 | Phenotypic ratio: |

|  |  |
| --- | --- |
| Example 2: Nematodes can have a normal body shape or a dumpy (shorter) body shape. Dumpiness is a recessive trait. A dumpy nematode is crossed with a homozygous ‘normal’ nematode. | |
| Step 1 | Dumpy nematode = Homozygous normal = |
| Steps 2 + 3 | |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  |   Genotypic ratio: |
| Step 4 | Phenotypic ratio: |

Example 3: Pea plants can be round (*R*) or wrinkled (*r*). Two heterozygote pea plants are crossed. Determine the genotypic and phenotypic ratios of the offspring.