Biology Genetic Inheritance - Heredity Cheat Sheet

by Kayla (Education Help23) via cheatography.com/201049/cs/42509/

Terms - Alphabetical

Allele: Different form of the same gene

Continuous Variation: Occurs when a phenotype shows multiple variations in a population through multiple genes

Gene: Basic unit of DNA - hereditary material.
It occupies a specific location on a chromosome and determines a particular characteristic in an organism

Genotype: An organisim's genetic information

Heredity: Transfer of traits from parent to offspring

Phenotype: Set of observable traits

Polygenic: Multiple genes contributing to one trait eg. height or weight.

Gregor Mendel

Studied the phenotypes of generations of peas.
Some of the pea plant phenotypes are:
- Purple flowers or white flowers
- Yellow seeds or green seeds
- Wrinkled seeds or round seeds
- Tall or short plants

Alleles

Humans have 2 alleles for each gene
Dominant allele: Will mask a recessive gene – **TT or Tt**
Recessive allele: Is only expressed when a gene has two of this type of allele – **tt**

Genotypes

Homozygous dominant genotype: 2 dominant alleles (TT or AA)

Homozygous recessive genotype: 2 recessive alleles (tt or aa)

Heterozygous genotype: one dominant allele and one recessive allele (Tt or Aa)

One-Trait Inheritance

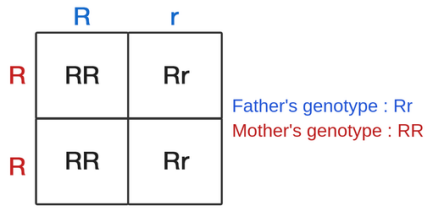
The types of gametes that are produced depends on the genotype of the parent cell.
Examples of one-trait inheritance
- Cheek dimples
- Free or attached earlobes
- Freckles

One-trait crosses consider only one set of alleles -
e.g. HH x Hh
Remember that a gamete (egg or sperm) has only
one allele
- e.g. a 'H' or a 'h'

Punnet Squares

Can be used to predict genotypes and phenotypes of offspring from genetic crosses.
Steps for a Punnet Square (based on the picture below)
Step 1: Figure our the genotypes of the parents - **Rr x RR**
Step 2: Place one Parent on the top and one on the outside
Step 3: Cross them. **Always make sure to put the capital letter first**

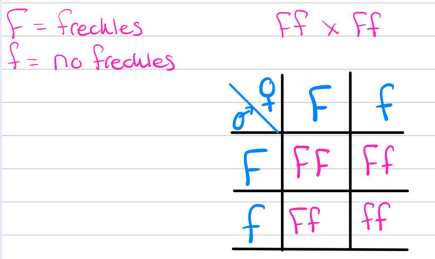
Punnet Squares



Monohybrid Cross

Both parents are heterozygous (or a hybrid) for a single (mono) trait.
Based on the picture below the trait is freckles.

Monohybrid Cross



Ratios

Genotypic ratio: the number of offspring with the same genotype
Phenotypic ratio: the number of offspring with the same outward appearance
What is the genotypic ratio for the Monohybrid cross above?
1: 2: 1 (1 FF: 2 Ff: 1 ff)
What is the phenotypic ratio?
3: 1 (3 with freckles and 1 with no freckles)
For a monohybrid cross, 3:1 phenotypic ratio is always expeccted when one allele is completely dominant over the other.

Test Crossing

Determine whether an organism with a dominant phenotype is homozygous or heterozygous.
The genotype is unknown (Hh or Hh)
Rules of a test cross
1. If the cross yeilds 100% dominant phenotype offspring, the parent is homozygous dominant.
2. If the cross yeilds 50% dominant phenotype and 50% recessive phenotype offspring, the parent is heterozygous.
Example shown in picture below.

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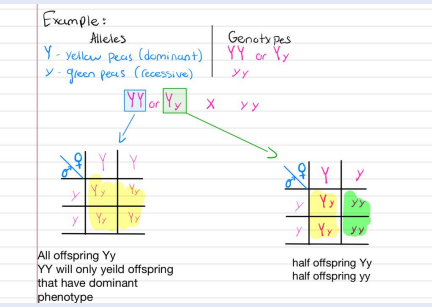
Test Crossing



Mendelian Laws

Law of Segregation

> During formation of gametes, the 2 traits carried by each parent will separate

Law of Independent Assortment

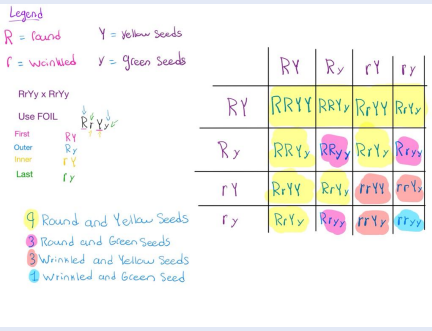
> The homologous pairs separate into gametes is completely random, so any possible combination can occur.

If the genes for two different traits are found on different chromosomes, we can use a dihybrid cross to look at the possible genotype and phenotype outcomes.

Dihybrid Cross

A cross between two individuals that carry two different traits that determines the probability of the traits being passed onto the offspring.
A dihybrid is heterozygous for 2 traits.
A dihybrid cross **always** gives a 9:3:3:1 phenotypic ratio

Dihybrid Cross



Non-Mendelian Inheritance

Polygenic Inheritance

> Multiple genes affect one trait (eg. hair colour, eye color, skin colour)

Incomplete Dominance

> Dominant allele is partially expressed, resulting in an intermediate phenotype (Eg. Red X White = Pink heterozygous).

Codominance

> both alleles are expressed in the hetero-zygote neither is dominant or recessive, but there is no blending

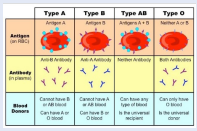
Sex-linked Inheritance

> Traits that are carried on by the sex chromosomes

Codominance - Blood Types

Different combinations of the three blood-type alleles produce four different possible phenotypes, or blood types (A, B, AB, and O)
I^A and I^B are completely dominant over i, and I^A is codominant with I^B
I^A -> dominant allele for blood type A
I^B -> dominant allele for blood type B
i -> recessive allele for blood type O
.

Blood Types Cont'



Type AB blood has no antibodies, any blood can be donated to them - universal acceptor

Type O - universal donor

X-linked Influences

Some inheritance patterns depend on which chromosomes the gene is located on. The X chromosome contains many genes that are not related to sex characteristics, and those genes are called X-linked (genes on the X chromosome unrelated to sex characteristics).
Human X-linked, recessive traits include hemophilia, which is a blood clotting disorder and red-green colour blindness. Each of these traits are much more common in males than females because males have only one X chromosome and females need to inherit two mutated alleles to have the disease

Genetic Disorders

Sickle-cell Anemia

> **Autosomal Recessive.** The hemoglobin gene is mutated, causing abnormal red blood cell formation and reduced capacity to carry oxygen.

Tay Sachs

> **Autosomal Recessive.** Lysosomal enzyme is mutated, causing brain deteri-oration leading to death

Cystic Fibrosis

> **Autosomal Recessive.** the chloride channel gene is mutated, causing altered water balance inside of cells, and this leads to excessive mucus produc-tion, which impacts the lungs, liver, pancreas, and sweat glands.

Huntington's Disease

> **Autosomal Dominant.** CAG nucleotide repeats are inserted into a gene that affects a protein in the brain.

Hemophilia

> **Recessive X-linked.** Affects a gene involved in blood clotting.