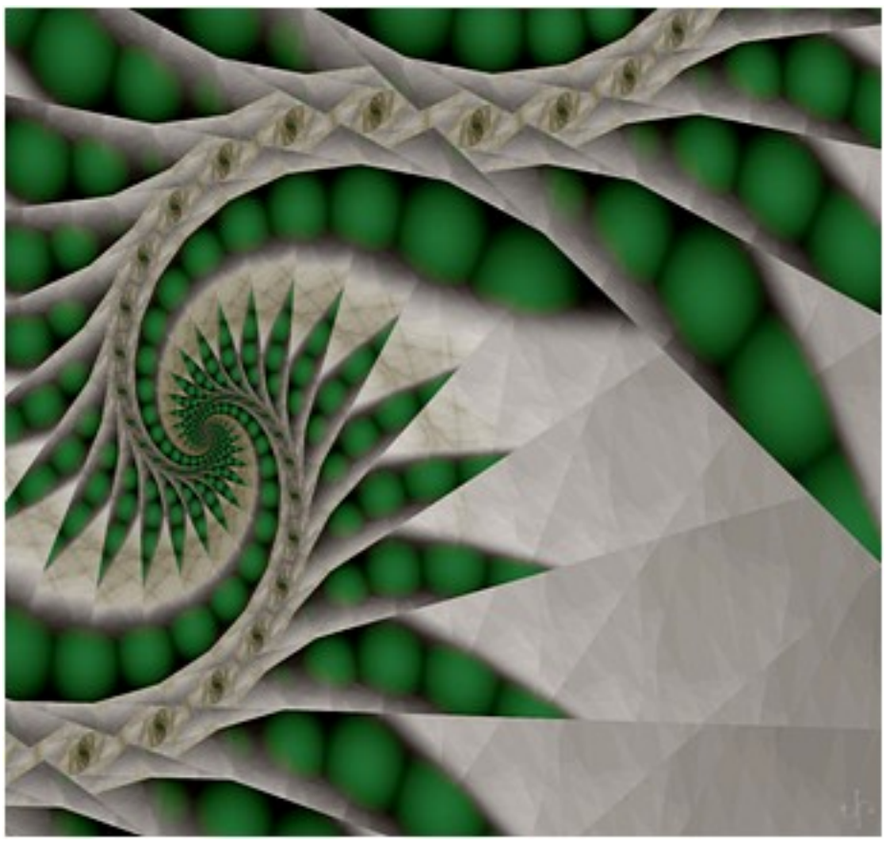
Part 2: Heredity and Mendelian Genetics



Mendel's Second Experiment: A Dihybrid Cross

Mendel's second major experiment involved the crossing of _____

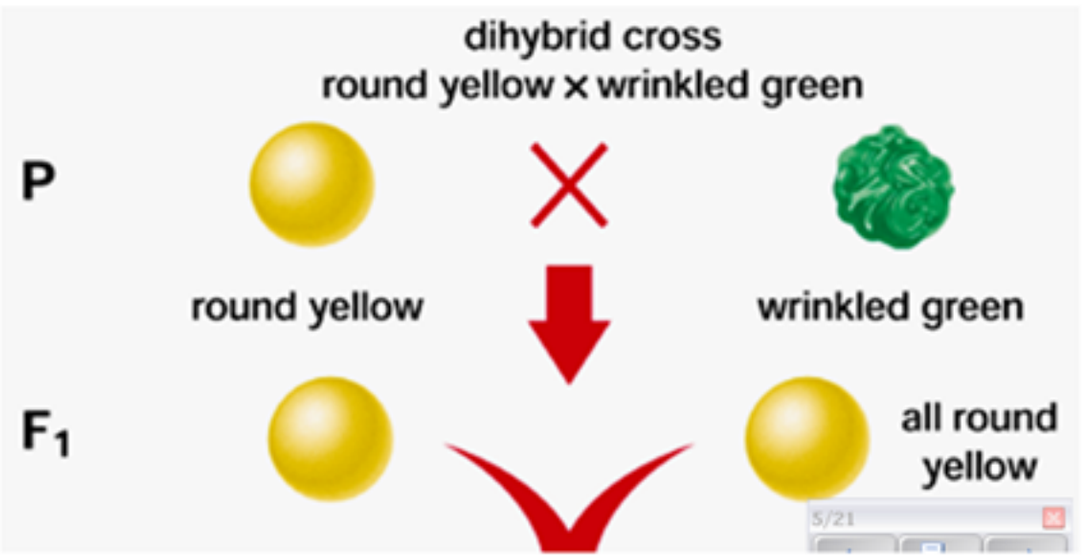
_____

Mendel wanted to discover if the ____

_____

(i.e. Did pea colour influence pea shape?)

Once again Mendel crossed _____ that were _____.



This time he observed __ _____.

The Determination of Gametes for a Dihybrid Cross.

When generating the possible gametes for a _____, one must predict the _____ _____. If the F1 generation are _____, then each parent can each produce _____.

The possible gametic alleles:

Each hybrid F1 individual has the genotype:

The possible gametic alleles are:

_____

Nine different genotypes and four different phenotypes result from a dihybrid cross of F1 plants.

Mendel discovered that all of the F1 generation _____

Mendel then crossed the F1 generation and discovered that the _____ _____. The F2 generations of other _____ also showed this ratio.

Of the 551 plants in Mendel's F2 generation, he observed the following traits:

Mendel's Law of Independent Assortment

The inheritance of alleles for one trait _____ _____ the inheritance of alleles for _____.
This means that the combination of alleles in the offspring _____.
(i.e. they sort _____.)

Probability

Genotypic and phenotypic ratios are determined by the _____ . The probability of an event is the likelihood that the event will occur. Probability can be expressed by the following formula:

In humans, free earlobes are controlled by the _____, and attached earlobes by the _____. The widow's peak hairline is regulated by the _____, while the straight hairline is controlled by the _____

(c)

Sample Problem 1

What are the probabilities of obtaining F1 offspring with the following characteristics if one parents is homozygous dominant for both traits and the other is heterozygous dominant for both ?

- **widow's peak and free earlobes**
- **straight hairline and free earlobes**
- **widow's peak and attached earlobes**
- **straight hairline and attached earlobes**

Check your answers by completing a Punnet Square!

Sample Problem 2

What is the probability that a child from the mating of the EeHh × EeHh parents
would be a male with a widow's peak and have attached earlobes? Write your probability as a percentage!

Mono and Dihybrid Cross Assignment Coming Soon!

Beyond Mendel's Laws

Although his research and examination of patterns of inheritance in the pea plant was revolutionary in genetics; _____

_____

_____

There are <u>three</u> other mechanisms of inheritance we will discuss in this course.

Incomplete Dominance

Not all traits are _____ or _____ as Mendel suggested. Some traits are _____, that is, there can be an _____ of a particular trait when the genotype is _____.

The snapdragon flower is incompletely dominant for flower colour.

_____ are required for a red flower i.e.

_____ are required for a white flower i.e.

_____ of alleles is required for a pink flower i.e.

_____

Incomplete Dominance in the Snapdragon Flower

Sample 1.
Determine the F1 phenotypic ratio of a cross between a pink and a white snapdragon.

Co-dominant Inheritance

In some cases _____ for a trait may _____.
Such alleles are said to be _____ because both alleles are _____ _____.

Shorthorn cattle have the mechanism of co-dominant inheritance for their coat colour.

The expression of _____ occurs and there is _____.
The _____ red coat alleles are: _____ (called "_____")
The _____coat alleles are: _____
The _____coat alleles are: _____

Sample 1.
Find the F1 phenotypes of a cross between a red cow and a roan bull.

Multiple Allelic Inheritance

For some traits more than _____

_____

Although a single individual cannot have more than _____for each trait, different individuals can have _____

_____

Human blood types have multiple allele inheritance.

Table 1: Dominance Hierarchy and Symbols for Eye Colour in *Drosophila*

Phenotype	Genotypes	Dominant over
wild type	E^1E^1, E^1E^2, E^1E^3, E^1E^4	apricot, honey, white
apricot	E^2E^2, E^2E^3, E^2E^4	honey, white
honey	E^3E^3, E^3E^4	white
white	E^4E^4	

Sample Problem

What is the phenotypic ratio of the offspring from the mating of the following *Drosophila*?

E^1E^4 (wild-type eye colour) × E^2E^3 (apricot eye colour)

Sex Linkage - X and Y

Some traits are inherited from _____

_____

This is known as _____ inheritance.

_____ are sex-linked traits.

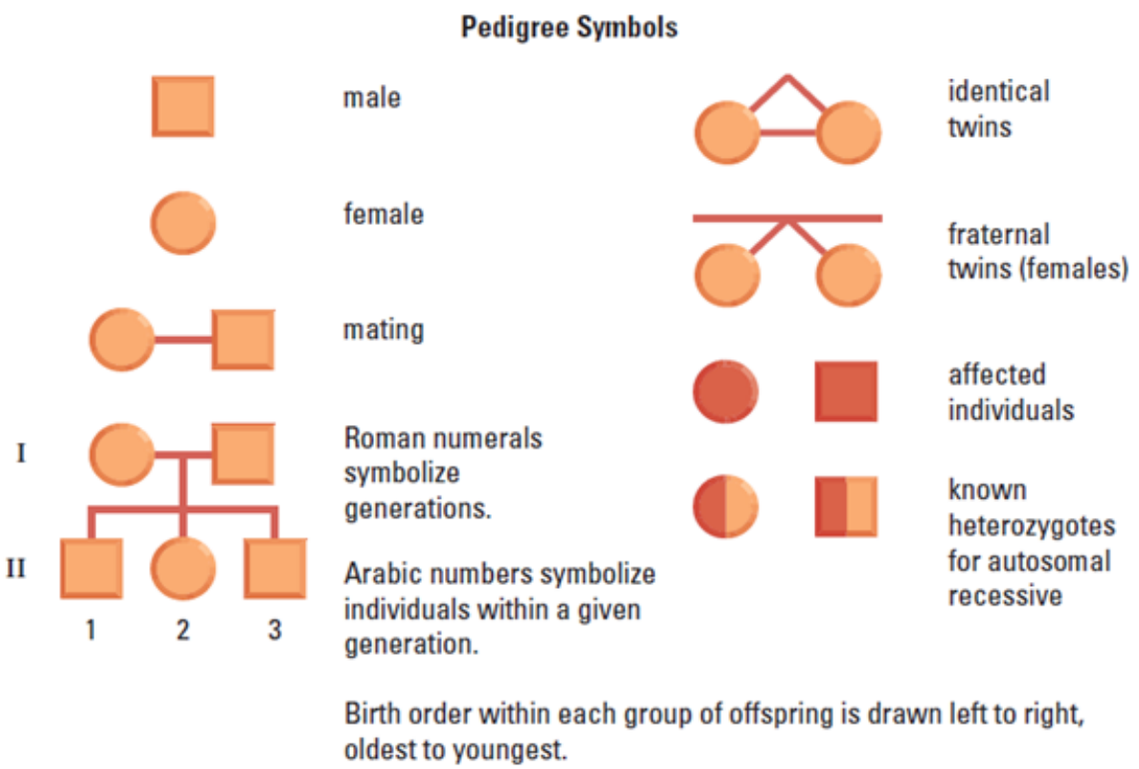
A male with hemophilia mates with a woman with no hemophiliac gene. What is the probability of producing sons or daughters who have hemophilia?

Pedigree Charts

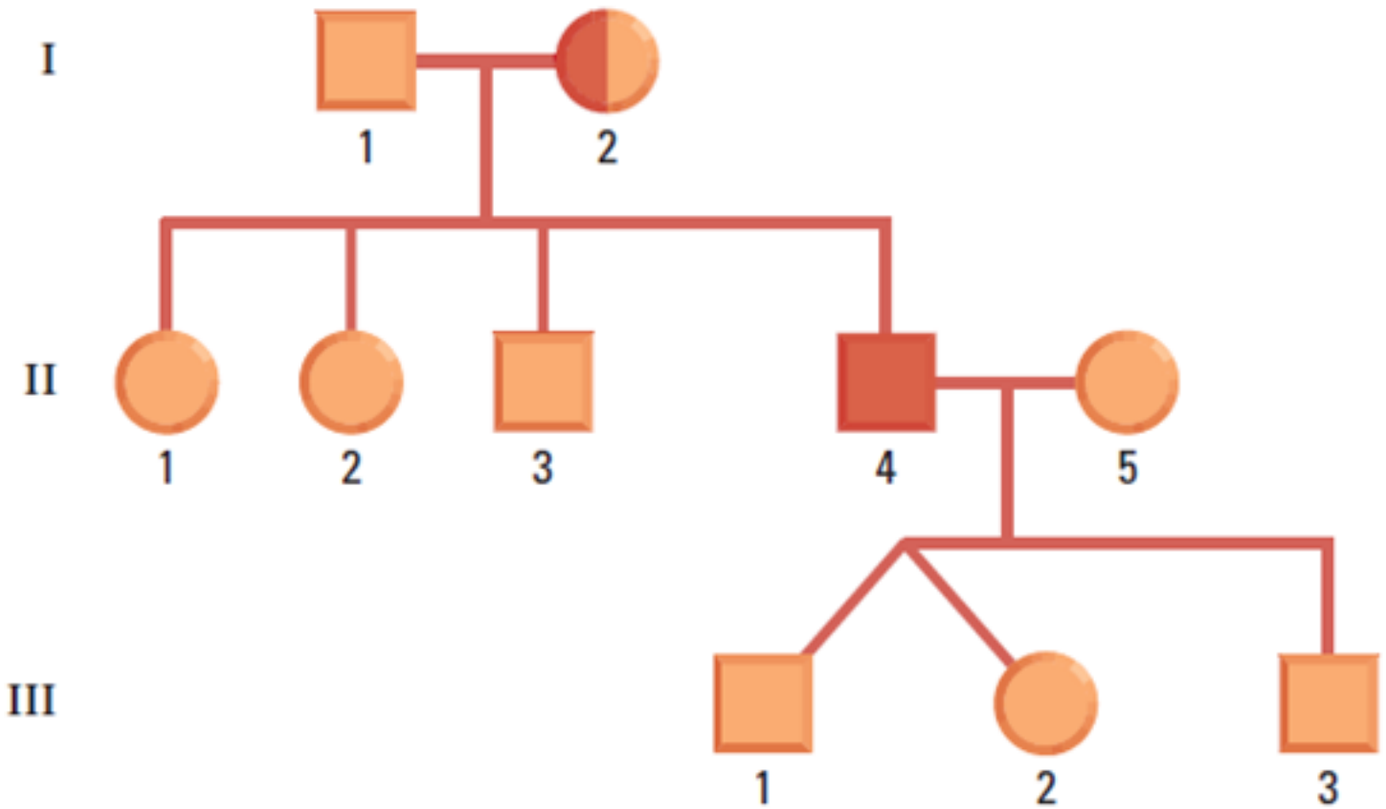
Pedigree analysis is useful when the _____ _____.

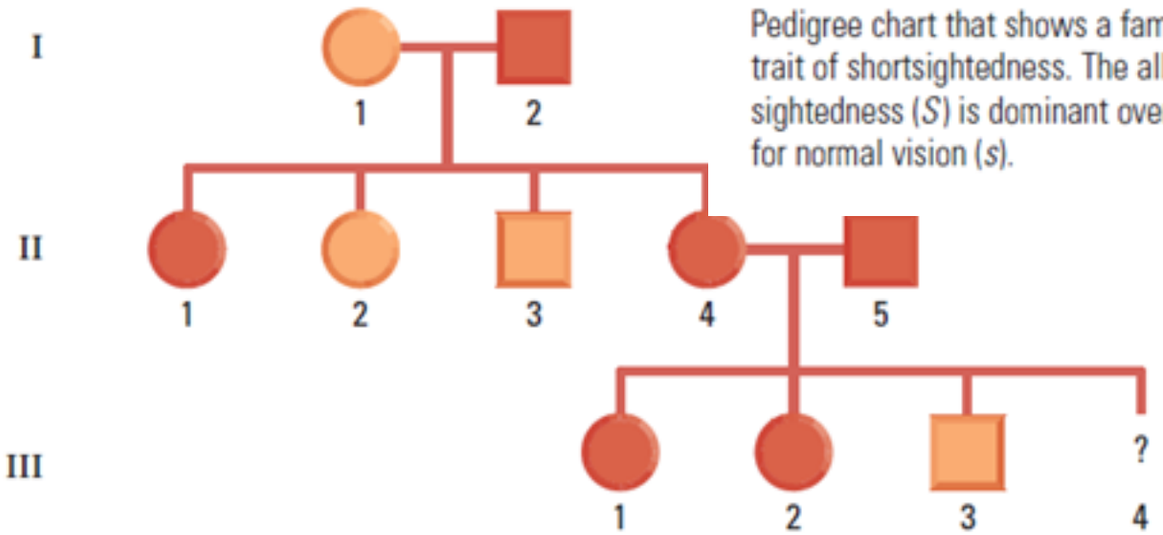
A pedigree chart can be used to trace the _____ _____.

A pedigree chart contains a _____.



Sample Pedigree





Pedigree chart that shows a family with the trait of shortsightedness. The allele for shortsightedness (*S*) is dominant over the allele for normal vision (*s*).

1. Indicate whether each family member is homozygous or heterozygous for shortsightedness, or homozygous for normal vision.
2. If couple 4 and 5 in row II had another child, what genotype might the child have? (Hint: What genotype is possible but not shown in the chart?) Would the child have normal vision or be shortsighted?