Mendelian Genetics
conducted a series of genetic experiments with _______ plants in the mid-1800’s.

Advantages:
- ________________ of offspring
- __________ reproductive cycle
- _________ to follow traits
- Can ________________
Flower Anatomy

Where the __________ sticks

During __________

Contains the __________ sex cell

(__________)

__________ sex cell

(__________)

- Pistil
- Stigma
- Style
- Ovary
- Stamen
- Anther
- Filament
- Ovule with Embryo Sac
- Petal
- Sepal
- Receptacle
- Peduncle
Mendel’s experiments

• He created pure breeds (or true breeds) by _________________traits in each generation until they _________________offspring with that trait. Example: Green seed pure breeds and Yellow seed pure breeds.

• He then cross these two pure breeds (Green X Yellow) to see what happened.
Mendel removed the ________ (male reproductive organ) to prevent self pollination.

He conducted a series of controlled experiments, in which he ________________ plants with specific traits.
Mendel’s Pea Plant Traits

- Round or wrinkled ripe seeds
- Yellow or green seed interiors
- Purple or white petals
- Green or yellow unripe pods
- Inflated or pinched ripe pods
- Axial or terminal flowers
- Long or short stems
Mendel crossed pure-breeding yellow seeded plants with pure-breeding green seeds. Yellow X Green. What do you think the results were?

In the F_1 generation ("F" stands for "Filial" which means "offspring", the "1" refers to the 1<sup>st</sup> generation), what do you think the results were?

In the F_2 generation of the offspring, what do you think he found?
Mendel knew ___________ parents provided information to their offspring for seed color, so each plant had ________ pieces of information for seed color (and all other traits).

He determined that the genetic information for yellow ___________ the green information. He called the information that masked _______________ and the one being masked ________________.

Each type of genetic information for a trait is called an ___________. Dominant alleles are ____________ letters, recessive _________________. Each characteristic uses ______ letter. (Ex: “_____” for yellow and “_____” for green)
Solving a Genetic Mystery

cross-pollination → parent generation

self-pollination → f1 generation

3:1 ratio → f2 generation
Gregor Mendel’s discovery

http://www.youtube.com/watch?v=0vAAf4g5iF8
Following the genetic information

For a single characteristic (such as height) each organism receives genetic info from ________ parent. The _______ pieces of information are then ______________________ to determine the physical trait observed. Example: In pea plants, height is determined by a single gene and two pieces of information.

The genetic information from the parent can be dominant or recessive. The genetic variations for a gene are know as alleles and are represented by letters. Example: T or t

Only ______ allele is passed on by each __________. There is an ______________ chance one or the other allele will be passed on.
Following the genetic information

Dominant information is represented by a capital letter. Often the letter of the ____________ trait is used (Example: T for tall) and the recessive information is ______ cased using the same letter (Example: t for short).

Every organism has __________ pieces of genetic information, alleles, for each characteristic. The combination of alleles is know as the __________________________(Example: TT, tt, or Tt)

The expression of the alleles that are ______________ is know as the __________________________ (example: Tall or short)
<table>
<thead>
<tr>
<th>Character</th>
<th>Dominant trait</th>
<th>Recessive trait</th>
<th>Character</th>
<th>Dominant trait</th>
<th>Recessive trait</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed shape</td>
<td>Spherical</td>
<td>Wrinkled</td>
<td>Flower position</td>
<td>Axial</td>
<td>Terminal</td>
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<tr>
<td>Seed color</td>
<td>Yellow</td>
<td>Green</td>
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<tr>
<td>Flower color</td>
<td>Purple</td>
<td>White</td>
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</tr>
<tr>
<td>Pod shape</td>
<td>Inflated</td>
<td>Constricted</td>
<td>Stem height</td>
<td>Tall</td>
<td>Dwarf</td>
</tr>
<tr>
<td>Pod color</td>
<td>Green</td>
<td>Yellow</td>
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</tbody>
</table>
Law of Segregation

Mendel concluded that each plant had two alleles for a trait and that those alleles ___________________ when the ______________ form.

(Meiosis – which was not known at the time.)

Tt   Genotype of parent

Two possible gametes - ______ would have “T” the other ________would have “t”
Law of Dominance

The dominant allele (gene form) is the allele that is ________________ in the F$_1$ generation. It is represented with a capital letter.

The recessive allele is the allele that can be ___________ by a dominant allele. It is represented by a lower case of the same letter.

Example:
Spherical seed (dominant) $S$
Wrinkled seed (recessive) $s$
Phenotype/Genotype

Phenotype:
The ______________ or expression of a gene.
Examples:  Long ears
           Sickle cell anemia
           Blue Eyes

Genotype:
The combination of ______________ contained in an organism.
Examples:  LL, Ll, ll
**Homozygous/Heterozygous Genotypes**

<table>
<thead>
<tr>
<th>Homozygous:</th>
<th>Heterozygous:</th>
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<tbody>
<tr>
<td>_____ of the _________ allele</td>
<td>2 ___________________________ alleles</td>
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<tr>
<td>___ is homozygous dominant</td>
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<tr>
<td>___ is homozygous recessive</td>
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</table>

Two individuals with the dominant trait have the same phenotype, but could have different ________________.

[BB] [Bb]
Applying the Concepts

The long-tail allele (L) is dominant in cats.
The short-tail allele (l) is recessive.

Can 2 long-tailed cats have a short-tailed offspring?

Can 2 short-tailed cats have a long-tailed offspring?
Analyzing Mendel’s Results

True breeding plants are ___________ for the trait.

The ____ generation was heterozygous.

In the F₂ generation, ___ out of ___ (____%) received at least one dominant allele.

___% chance of receiving recessive allele from both parent. (___ x ___ = ___)
Punnett squares can be used to determine the __________ from two parent genotypes, and the _________________.

The ______ in the possible ______ for each parent are written on the 2 sides. Filling in the squares shows the probability of each __________ ______________ combination.

Example: Dd x dd
Review of Probability

To find the overall probability of 2 independent events, multiply the probability of each.

Example:

Heads twice = \( \frac{1}{2} \times \frac{1}{2} = ____ \)

Tails twice = \( \frac{1}{2} \times \frac{1}{2} = ____ \)

One heads and one tails = \( \frac{1}{2} \times \frac{1}{2} \times 2 = \frac{1}{2} \)

(2 possibilities- heads then tails or tails then heads)
Expressing Probability

- Probability can be expressed as a frequency, likelihood of something to occur based on probability.

- Frequency can be expressed as a fraction, percent, or ratio.

- If the probability only has one option, express it as a percent (100%).

- If there is no chance for something to occur, express it as 0%.

- Ratios and fractions need to compare at least two things to each other.

- Always reduce!
Both parents are heterozygous for the tongue rolling gene. (Tongue rolling is dominant R, non tongue rolling is recessive r) Rr x Rr

**Phenotype Frequency:**

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____ rollers, ____ Non rollers
____% rollers, ____% Non rollers
____ rollers : ______ Non roller

**Genotype Frequency:**

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____ RR, ____ Rr, ____ rr
____% RR, ____%, Rr, ____% rr
____ RR: ___ Rr: ___ rr
Hitchhiker thumb is a dominant allele (H). Non-hitchhiker is a recessive allele (h).

If one parent is heterozygous for Hitchhiker thumb (Hr), and the other parent is a non-hitchhiker (hh), what are their probabilities of having hitchhiker or non-hitchhiker thumb children? (Hh x hh)

Phenotype frequency:
If one fruit fly is homozygous dominant for normal wings (WW) and the other has vestigial wings (ww), what are the possible offspring?
Punnett Square Disclaimer

Remember that probabilities are more accurate with a ________________________.

Actual outcomes are often _________________ from expected probabilities when the sample size is ______, due to _________________ fluctuations.
Reviewing Main Concepts

1. How many alleles do you have for each trait?

2. How many alleles do you pass on to your children for each trait?

Define:

**Heterozygous:**

**Homozygous:**

**Phenotype:**

**Genotype:**