Mendel and Heredity
Chapter 8
Ms. Hogg, Biology

The Origins of Genetics

• Heredity – the passing of characteristics from parent to offspring
  – Before DNA and chromosomes were discovered, heredity was one of the greatest mysteries of science!
Gregor Mendel

• The scientific study of heredity began with Gregor Mendel
  – Austrian monk
  – Carried out experiments with garden peas
  – He was the 1st to develop rules that accurately predict patterns of heredity.
  – “Father of Genetics”

Pea Plant
7 Characteristics Mendel Studied:

<table>
<thead>
<tr>
<th>Trait</th>
<th>Variants</th>
<th>Trait</th>
<th>Variants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed color</td>
<td>Yellow, Green</td>
<td>Seed shape</td>
<td>Round, Wrinkled</td>
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<tr>
<td>Seed shape</td>
<td>Round, Wrinkled</td>
<td>Pod color</td>
<td>Green, Yellow</td>
</tr>
<tr>
<td>Flower color</td>
<td>Purple, White</td>
<td>Pod shape</td>
<td>Smooth, Constricted</td>
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<tr>
<td>Flower position</td>
<td>Axial, Terminal</td>
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Pollen Transfer in Mendel’s Experiments
Mendel’s Hypotheses

#1

• For each inherited characteristic, an individual has **two** copies of the gene – one from each parent.

Mendel’s Hypotheses

#2

• There are alternative versions of genes.
  – These different “versions” are called **alleles**.
  – An individual receives one allele from each parent.
Mendel’s Hypotheses

#3

- When two different alleles occur together, one of them may be completely expressed, while the other may have no observable affect on the organisms appearance.

- **Dominant** = expressed trait
- **Recessive** = trait that is NOT expressed

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<th>pistil</th>
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<tbody>
<tr>
<td>♀</td>
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Mendel’s Hypotheses
#4

• When gametes are formed, the alleles for each gene in an individual separate independently of one another.

Terms of Genetics

• **Homozygous** = two alleles of a gene are the SAME
  – Example: \textbf{BB} or \textbf{bb}

• **Heterozygous** = two alleles of a gene are DIFFERENT
  – Example: \textbf{Bb}
Terms of Genetics

- **Genotype** = the set of alleles that an individual has for a trait
  - Example: BB

- **Phenotype** = the physical appearance of a characteristic
  - Example = Brown hair

Punnett Square

- A punnett square is a diagram that predicts the outcome of a genetic cross

- Monohybrid cross:

![Punnett Square Diagram](image)
**Genetics:**

**Parental Generation (F):**
- **RR** × **rr**
- "self-pollinated" resulting in **F1 generation**
  - **Rr**

**F1 Generation:**
- **Pollen:**
  - **R**
  - **r**

**F2 Generation:**
- **Seeds:**
  - **RR**
  - **Rr**
  - **rr**

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The Hardy-Weinberg Principle

\[ p^2 + 2pq + q^2 = 1 \]

You can use this equation to predict genotype frequencies in a population.

The sum of allele frequencies must always equal 1.

\[ p + q = 1 \]
Exceptions...

- The Hardy-Weinberg principle holds true for any population as long as evolutionary forces are not acting...
  - Mutations
  - Gene flow
  - Nonrandom mating
  - Genetic drift
  - Natural selection