OUTLINE 11

II. Theories of Inheritance
   A. Informal knowledge
   B. Early theories
      1. Hippocrates - direct, blending inheritance
      2. Aristotle - criticisms of blending inheritance
   C. Knowledge of sexual reproduction
      1. spontaneous generation
      2. Animalculists vs Ovists

III. Mendel - A New Theory
   A. Who was Mendel?
   B. What did Mendel know?
   C. Plant breeding

IV. Mendel's work
   A. Monohybrid cross
   B. Interpretation in modern terms
      gene dominant homozygous genotype
      locus recessive heterozygous phenotype allele
   C. Quantitative results
      1. quantitative results of monohybrid cross
      2. tools for predicting patterns of inheritance
         Punnet square
         test cross
Patterns of Inheritance

- twins
- sisters
- brothers
- Family
- Mom and offspring

Father and son
The Homunculus
Gregor Mendel

Two Varieties of Sweet Peas
Fig. 14.1

Plant Breeding

1. Removed stamens from purple flower
2. Transferred pollen from stamens of white flower to carpel of purple flower
3. Pollinated carpel matured into pod
4. Planted seeds from pod
5. Examined offspring: all purple flowers
Some discrete characters in peas
### Table 14.1 The Results of Mendel’s F<sub>1</sub> Crosses for Seven Characters in Pea Plants

<table>
<thead>
<tr>
<th>Character</th>
<th>Dominant Trait</th>
<th>×</th>
<th>Recessive Trait</th>
<th>F&lt;sub&gt;2&lt;/sub&gt; Generation Dominant:Recessive</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flower color</td>
<td>Purple</td>
<td>×</td>
<td>White</td>
<td>705:224</td>
<td>3.15:1</td>
</tr>
<tr>
<td>Flower position</td>
<td>Axial</td>
<td>×</td>
<td>Terminal</td>
<td>651:207</td>
<td>3.14:1</td>
</tr>
<tr>
<td>Seed color</td>
<td>Yellow</td>
<td>×</td>
<td>Green</td>
<td>6022:2001</td>
<td>3.01:1</td>
</tr>
<tr>
<td>Seed shape</td>
<td>Round</td>
<td>×</td>
<td>Wrinkled</td>
<td>5474:1850</td>
<td>2.96:1</td>
</tr>
<tr>
<td>Pod shape</td>
<td>Inflated</td>
<td>×</td>
<td>Constricted</td>
<td>882:299</td>
<td>2.95:1</td>
</tr>
<tr>
<td>Pod color</td>
<td>Green</td>
<td>×</td>
<td>Yellow</td>
<td>428:152</td>
<td>2.82:1</td>
</tr>
<tr>
<td>Stem length</td>
<td>Tall</td>
<td>×</td>
<td>Dwarf</td>
<td>787:277</td>
<td>2.84:1</td>
</tr>
</tbody>
</table>
Fig 14.2  A monohybrid cross

P Generation
(true-breeding parents)

Purple flowers × White flowers

F₁ Generation
(hybrids)

All plants had purple flowers

F₂ Generation
Ratio 3:1

705 plants had purple flowers
224 plants had white flowers
Homozygous

P

Heterozygous

P

g

P

p
Fig. 14.6

A Test Cross

- **Dominant phenotype, unknown genotype:**
  - $PP$ or $Pp$?

- **Recessive phenotype, known genotype:**
  - $pp$

- If $PP$, then all offspring purple:

- If $Pp$, then $\frac{1}{2}$ offspring purple and $\frac{1}{2}$ offspring white: