

Chapter 16 – Mendelian Genetics

Part A

I. Introduction to Mendel's Experiments

A. Studied **trait inheritance**

B. “**Blended Inheritance**” was the popular idea at the time

1. Offspring were “averages” of their parents
 - a. Tall father + short mother = medium children
 - b. Their children would pass on the trait of medium height to their offspring

C. **Mendel's Model System: peas**

1. Normally self-fertilize
2. Used **true-breeding** plants that when **self-fertilized** produced offspring with consistent traits
3. Focused on 7 traits, 2 variants of each one
4. Cross-fertilized his variants

D. **Single-Factor Cross: focuses on 1 trait**

1. P = parental
2. F₁ = first filial generation (offspring of P cross)
 - a. Offspring are monohybrids
3. F₂ generation: offspring of F₁ cross

E. **Plant height experiment**

1. P generation (true-breeding): tall x short
 - a. “True breeding” = TT x tt
 - b. Based on theories at the time, experiment should yield medium plants but produces all tall
 - c. F₁ is not true breeding
2. “P” = TT & tt plants
3. F₁ = Tt plants produced from P cross

	T	T
t	Tt	Tt
t	Tt	Tt



P cross (true breeding; TT x tt)

F₁ cross (Tt x Tt)

	T	t
T	TT	Tt
t	Tt	tt

4. Tt = **heterozygous**; TT = **homozygous dominant**; tt = **homozygous recessive**
5. Data supports **particulate inheritance**
 - a. Offspring inherit traits as unchanging, discrete hereditary units (genes)

II. Genes come in different forms: Alleles

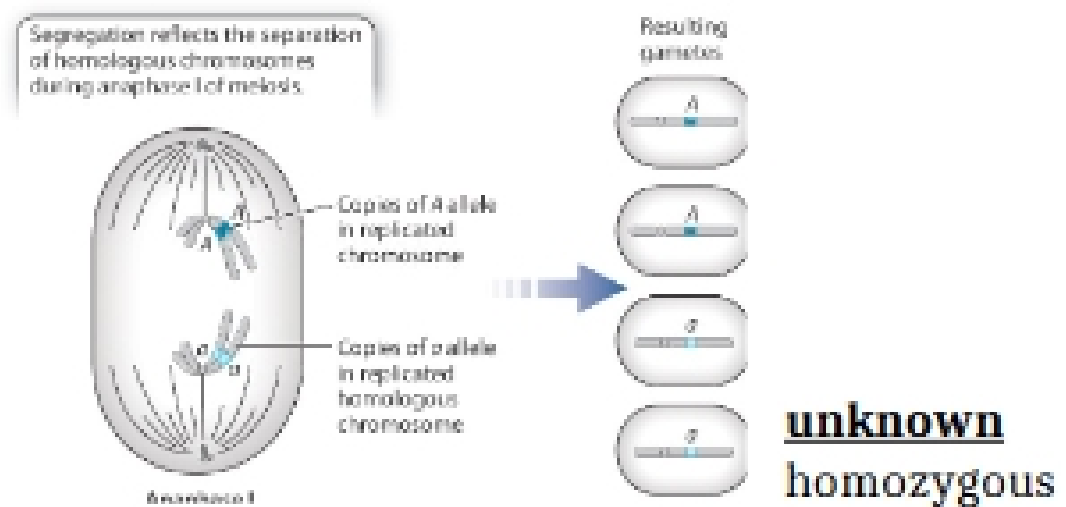
A. **Dominant/recessive**

1. Incomplete dominance: cases where 2 alleles, if both present, both contribute to phenotype

B. Location of Gene on chromosomes is its **locus**

C. **Principle of Segregation**: alleles are separated during gamete formation (**fig. 16.9**)

1.



III. Test Cross

A. Cross to determine genotype of an

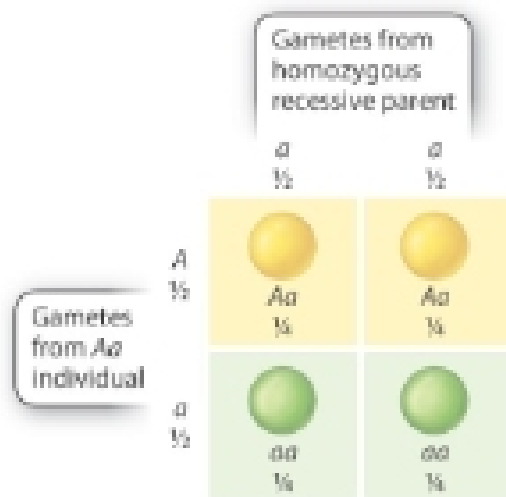
B. Crosses unknown genotype with a recessive (aa) individual to reveal the unknown genotype, based on resulting plants

1. Ex. Cross an unknown tall plant (Could be TT or Tt) with a tt

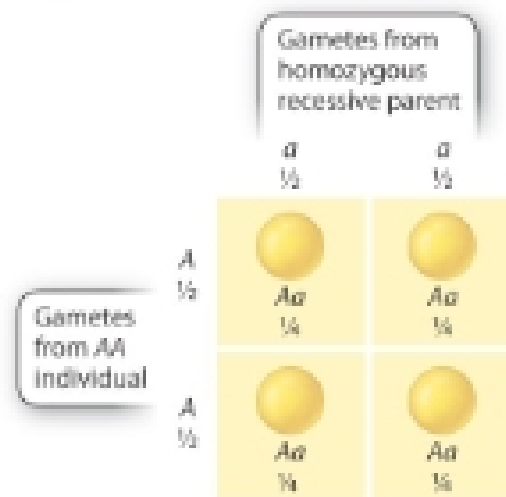
a. If some of the F₁ plants are short, unknown parent is Tt

b. If all F₁ plants are tall, unknown parent is TT

a. Aa x aa



b. AA x aa



Part B

I. Predicting Trait Inheritance Patterns (Probability Rules)

A. Product Rule

- If 2 or more independent events need to occur, probability of both happening is the product of each one's individual probability
- Ex. Tossing a coin: probability it will land on heads **both** times = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

B. Addition Rule

- Probability that one of two or more **mutually exclusive outcomes will occur**: add the probabilities of the possible outcomes
 - Ex. Tossing a coin: probability it will land on heads **or** tails = $\frac{1}{2} + \frac{1}{2} = 1$ (100% chance)

II. Inheritance of 2 Traits

A. 2 factor cross (ex. seed color and shape)

B. Possibilities

- 2 genes are physically **linked**, and are always inherited as a unit
 - Offspring will have same trait combinations as their parents
- 2 genes are **not linked**, and are inherited independently of each other
 - Some offspring will show new trait combinations

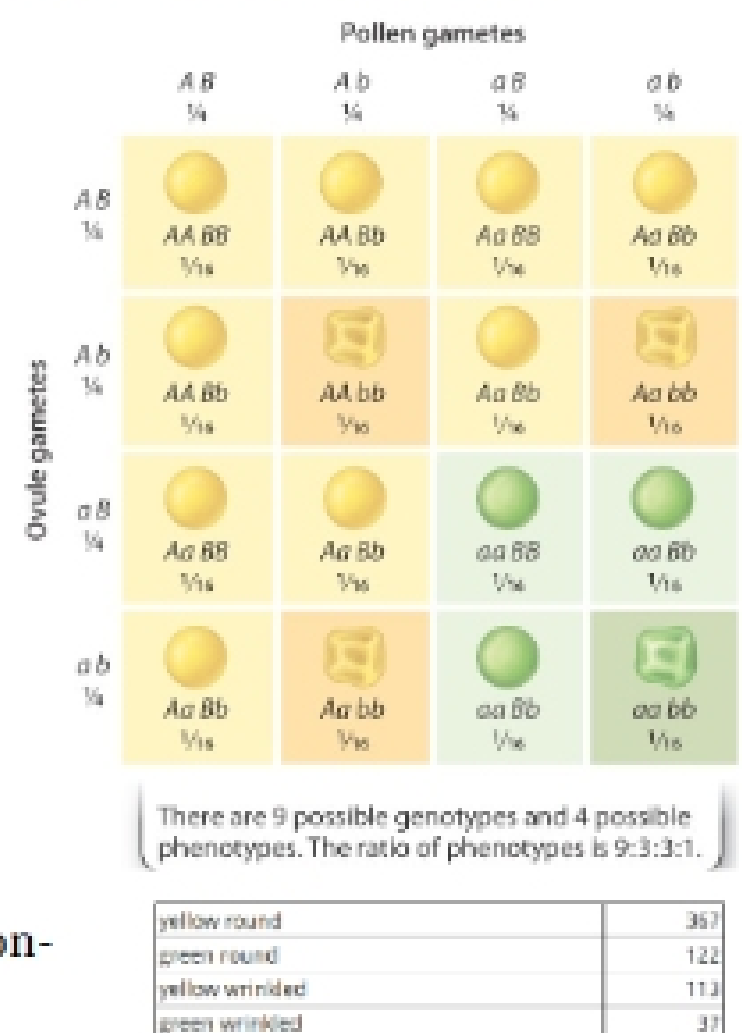
C. Example: Yellow/Round peas x Green/wrinkled

- Trait 1 = color; trait 2 = wrinkled vs. round
 - A = yellow; a = green
 - B = round; b = wrinkled
- Resulting plants show near perfect results expected based on punnett square, proving genes for color and skin type are **not linked**:

D. Leads to Mendel's Law of Independent Assortment

- Genes on different chromosomes are inherited independently (non-linked)
- Fig. 16.15**

E. Phenotypic Ratios can be modified by interactions between genes (**Fig. 16.16**)(next page)



Independent assortment of genes in different chromosomes reflects the fact that nonhomologous chromosomes can orient in either of two ways that are equally likely.

