

**Chapter 14 (Part 1)**  
**Mendel and the Gene Theory**

class notes

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**I. Popular 19<sup>th</sup> Century Model-**  
***The Blending Theory***

- All traits are mixed over time.
- Once the traits are blended, they cannot be separated.

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**II. Gregor Mendel**  
***Father of Modern Genetics***

- Raised in a farming community
- Trained in Math/Science
- Monk at St. Thomas' Monastery
- Conducted research on inheritance using garden peas.

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**III. Mendel's Particulate Theory of Inheritance**

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**IV. Why did Mendel use Peas?**

- Easily cultivated.
- Large number of offspring produced each growing season.

- NOTE ABOUT TERMS:  
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**IV. Why did Mendel use Peas?**

- Peas contain ♂pollen and ♀egg in same flower and naturally self-fertilize.

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## V. Useful Vocabulary

- Dominant vs. Recessive Traits (or Alleles)
- Genotype
  - Homozygous Dominant (AA)
  - Heterozygous (Aa)
  - Homozygous Recessive (aa)
- Phenotype
- True-Breeding vs. Hybrids

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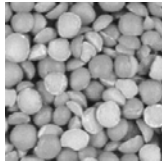
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## Question 14.1

a.



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## VI. Mendel's *Law of Segregation*

1. A sexually producing organism has two determinants (alleles).
2. These alleles separate (segregate) during gamete formation.
3. In hybrid offspring, a dominant allele can *mask* a recessive allele.

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**VII. Mendel conducted experiments over many generations.**

- Parental cross
- F1 self-pollination
- Additional crosses and/or self-pollinations with F2, F3, F4...

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**VIII. Using Punnett Squares to Explain Mendel's Work**

*Steps for Creating a Punnett Square:*

- 1.
- 2.
- 3.

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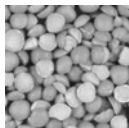
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**IX. Test Cross**

- PURPOSE:



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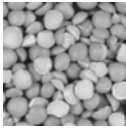
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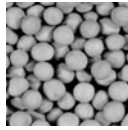
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### Question 14.2



Phenotype : Plant w/ yellow seeds  
Genotype: Y<sub>2</sub>

X



Phenotype : Plant with green seeds  
Genotype: yy

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### X. Mendel's Law of Independent Assortment

- (Modern Terms)

| Character       | Trait           | Chromosome # |
|-----------------|-----------------|--------------|
| Seed shape      | round-wrinkled  | 7            |
| Seed color      | yellow-green    | 1            |
| Pod color       | green-yellow    | 5            |
| Pod texture     | smooth-wrinkled | 4            |
| Flower color    | purple-white    | 1            |
| Flower location | axial-terminal  | 4            |
| Plant height    | tall-dwarf      | 4            |

(2 slides)

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### XI. Dihybrid Crosses

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- P generation: Y<sub>2</sub>Y<sub>2</sub> x yy
- F<sub>1</sub> generation?

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### Question 14.3

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### XI. Dihybrid Crosses

- Plants in the F1 generation allowed to self-pollinate:  
 $YyRr \times YyRr$

- F2 generation?

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### XII. Multiplication Rule

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- Used to deduce genotype in dihybrid, trihybrid, and tetrahybrid crosses.

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### Question 14.4

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Yy x Yy

Rr x Rr

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### Chapter 14 (Part 2)

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### I. Many Human Traits Follow Mendelian Genetics

#### A. Recessive Inherited Disorders

A. Tay-Sachs disease = lowercase t (Jewish-Central European origin)

B. Cystic Fibrosis = lowercase c (European origin)

C. Sickle Cell = H<sup>S</sup> (African origin)

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## I. Many Human Traits Follow Mendelian Genetics

### A. Dominant Inherited Disorders

- A. **Polydactyly**= uppercase P (extra fingers and toes)
- B. **Achondroplasia** = uppercase A (one form of dwarfism)
- C. **Huntington's Disease** = uppercase H (degeneration of the nervous system beginning at 35-45 years old)

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NOTE:

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## Questions 14.5

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## Questions 14.6

Most **Lethal** dominant alleles are ***not*** passed on from one generation to the next. Why **not**?

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**II. Inheritance patterns are often more complex**

**A. Codominance –**

**B. Incomplete dominance –**

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**II. Inheritance patterns are often more complex**

**C. Multiple Alleles on the same gene-  
ABO blood grouping**

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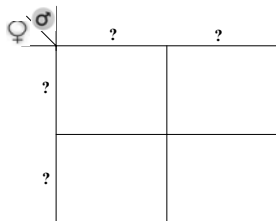
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**Question 14.7**



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**II. Inheritance patterns are often more complex**

**D. Pleiotropy =**

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**II. Inheritance patterns are often more complex**

**E. Polygenic inheritance =**

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**III. Environmental Impact of Phenotype**

• *Multifactorial* traits =

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### Question 14.8

- Comparing identical twins (*identical genes; similar environment*) with fraternal twins (*different combo of genes; similar environment*) can provide insight into the contribution of genes on disease.

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### Screening for Genetic Diseases

- Fetal Testing
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- Newborn Screening
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