Name Notes filled In Hour

Unit 7: Genetics (CHAPTER 11 in textbook)

Learning Goals

1. I can explain Mendel's contributions to genetics.
   Gregor Mendel & Working Backwards Notes (p. 5-6)

2. I can determine the possible offspring genotypes and phenotypes of a monohybrid cross using the Mendelian inheritance pattern.
   Introduction to Mendelian Genetics Notes (p. 3-4)
   HW 7 – 1 (handout)

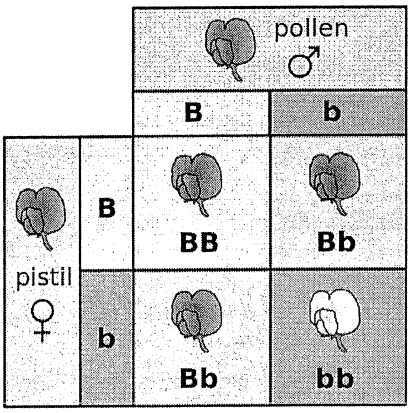
3. I can determine the possible offspring genotypes and phenotypes of a monohybrid cross using non-Mendelian inheritance (codominance, incomplete dominance & multiple alleles).
   Non-Mendelian Inheritance Pattern Notes (p. 7)
   Lab – Easter Egg Genetics (handout)
   HW 7 – 3 (handout)

4. I can determine parental genotypes if provided parental and offspring phenotypes.
   Gregor Mendel & Working Backwards Notes (p. 3-4)
   HW 7 – 2 (handout)

5. I can set up a test-cross to determine a parent's genotype.
   Gregor Mendel & Working Backwards Notes (p. 3-4)
   HW 7 – 2 (handout)

6. I can determine the possible allele combinations for a dihybrid cross.
   The Dihybrid Cross Notes (p. 9)
   HW 7 – 4 (handout)

7. I can determine the possible offspring phenotypes of a dihybrid cross.
   The Dihybrid Cross Notes (p. 9)
   HW 7 – 4 (handout)



8. I can explain the law of independent assortment and its effects on allele combinations.
   The Law of Independent Assortment Notes (p. 8)

Vocabulary (*Flashcards, p. 11*)

- Allele
- Codominance
- Dominant
- Gamete
- Gene
- Genetics
- Genotype
- Gregor Mendel
- Heterozygous
- Homozygous
- Incomplete dominance
- Law of independent assortment
- Multiple alleles
- Phenotype
- Polygenic trait
- Punnet Square
- Recessive
- Trait

Biology A & B Syllabus

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Purpose/Course Description:

The field of biology is ever changing. New advances in such things as pharmaceuticals and stem cell research make headlines daily. There is also concern for the health of the environment. As adults, students will have the opportunity to vote on these topics. This course will provide students with a basic understanding of biology concepts so that they may relate to the world around them and make informed decisions.

Topics, Key Concepts, and Units of Study:

- **Biology A**: Scientific Method and Reasoning, Organic Compounds, Photosynthesis, Cellular Respiration, Protein Synthesis, Cell Structure, Function and Life Cycle, and Genetics.
- **Biology B**: Scientific Method and Reasoning, Applications of Genetics, Biomes and Ecosystems, Population/Demographics, Human Impact, Evolution and Classification.

Textbooks Used and Other Sources:

- Prentice Hall: Biology (Dragonfly Edition) – textbooks are not handed out to each student, they are used as a reference in the classroom. If a student would like to have a text book at home for the trimester, he or she may request one. The book may also be found online by going to the weebly site and clicking on the "Online Biology Book" link on the BIO A page.
- Class website: www.GLScience.weebly.com

Materials Needed (Supplies Suggested):

- 3-Ring Binder (1½" works best)
- Dividers for 7 units
- Pencils
- Pencil case or ziploc bag for holding flashcards

Methods of Instruction:

- Demonstration and hands-on laboratory investigations
- Lecture, discussion and groupwork
- Videos and online simulations

Evaluation/Grade Calculations:

Trimester Marking Period Grades

- Asessments – 80%
- Assignments – 20%

Trimester Final Grade

- Trimester marking period – 90%
- Trimester Exam – 10%

Types of Evaluation and Assessment:

Student grades will be based on tests, quizzes, labs and homework.

Grading Scale:

93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+

73-76	C
70-72	C-
67-69	D+
63-66	D
60-62	D-
0-59	F

Assignment Expectations:

- Students will turn in their own neat and orderly work on the due date.
- Not all assignments will be of the same level of difficulty, however students will put in the amount of effort necessary to understand and complete the assignment successfully. This may include asking for help during class or staying for help after school.
- See attendance policy for make-up work expectations.

Late Assignments:

- Students can earn up to 80% on any late assignment. Daily homework is graded on completion and is not accepted late.

Test Retakes:

- Students will be allowed to retake any test. Unit tests must be made up within one week of the day of the original test. The retake score will be the final test score in the grade book. Retakes must be completed outside of class time (before or after school or during lunch). Note: Quizzes and other assignments may not be retaken or resubmitted.

Student Expectations:

- Students will respect all property, persons (including oneself) and the learning environment within the classroom.
- Examples of disrespectful behavior include:
    - Talking/listening to music during instruction
    - Copying the work of others
    - Writing on desks/lab stations
    - Misusing materials

Consequences:

- Unsafe or irresponsible lab practices will result in a zero for the lab and disciplinary action.
- Students not meeting other expectations will face the following consequences:
    1. Verbal Warning
    2. Removal from Class/Meeting with Instructor
    3. Phone Call Home/Meeting with Administrator
    4. Possible In-School Suspension/Out of School Suspension (More immediate consequences may result depending upon the level of the situation)

Cheating:

The act of obtaining answers or completing assignments in a fraudulent or deceitful manner. Disciplinary action will be determined by staff and administrators. Possible zero grade for assignment and possible suspension. (One hour – three days)

Attendance/Tardy:

The High School attendance/tardy policy is available on-line in the student handbook at:
http://www.glps.k12.mi.us/ourschools/grandledgehighschool/

Introduction to the Classroom

1. What is the late work policy?

2. What can be retaken?
   How long do I have to retake them?
   What time of day can I retake them?
   Which score counts?

3. What materials should I have to be successful in this class?

4. How much is daily homework worth?
   Can I turn in daily homework late?

5. How much of my grade are tests and quizzes worth?
6. What is the most effective way to raise my grade?
7. So, how can I do well on tests?

8. What is the hall pass?

   When is it never appropriate to use the hall pass?

   How many people can use the hall pass at a time?

9. Where do I put **RETURNALE** bottles and cans?
   Where do I put **NONRETURNABLE** bottles and cans?

10. What is the name of the classroom pet?
    What type of snake is he?
    When can I hold him?
    What does he eat?

11. Where should my phone be during class?

12. What will happen if I touch my phone during class?

13. Where should my ear buds be during class?

14. When is the only time during class that something can be plugged into my head?

15. What is the first thing that I do when I am absent?

16. Where are the copies located?

17. If I miss a quiz or test on the first day of my absence, when do I need to make it up?

18. If I miss a lab, what should I do?

19. If I miss notes, what should I do?

20. If I don't understand something, what is my job?!?!

21. My GOAL GRADE for this class is:_____

Introduction to Mendelian Genetics Notes

Learning Goal:

2. *I can determine the possible offspring genotypes and phenotypes of a monohybrid cross using the Mendelian inheritance pattern.*

Vocabulary

- **Genetics:** The study of heredity
- **Gene:** A section of DNA that codes for a protein
- **Trait:** Characteristic (often) determined by genes (ie pea plant height.)
- **Allele:** A version of the trait/gene (ie. taller short)

Mendelian Traits - For every trait a person receives 2 alleles (one from mom & one from dad)

Naming alleles:

1. First letter of the dominant trait
2. Dominant trait – CAPITAL letter
3. Recessive trait – LOWER CASE letter

Note: Same letter for both, one capital & one lower-case

Example: Plant height - Tallness is dominant over shortness. What letter will you choose?

- Tall allele – T
- Short allele – t

- **Genotype:**

(or "what two allele letters does an individual have?")

Possible allele combinations for plant height:

- TT (homozygous dominant)
- Tt (heterozygous)
- tt (homozygous recessive)

- **Phenotype:**

Examples:

For TT – Tall

For Tt – Tall (dominant allele is shown)

For tt – Short

Practice with Vocabulary

- Red fur is dominant to black fur. Name the alleles.

  Red – R Black – r

- What are the genotypes & phenotypes for the following individuals:

Individual	Genotype	Phenotype
Homozygous dominant	RR	Red
Heterozygous	Rr	Red
Homozygous recessive	rr	Black

Punnet Squares – Monohybrid Crosses

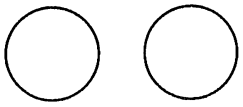
- **Punnet Square:** Tool that shows the possible offspring genotype of two parents

Example Problem:
Tallness is dominant to shortness in pea plants. Two heterozygous pea plants are mated. What are the genotypic and phenotypic ratios of the potential offspring? 2 Tt

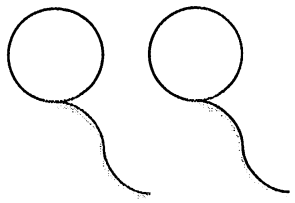
Steps to Solve Problem:

1. Determine genotypes of parents. Each of the alleles in the genotype will end up in a different gamete (remember that homologous chromosomes separate during anaphase I of meiosis so that each parent can only give half of it's DNA to its offspring)

   a. Parent #1: Tt

   b. Parent #2: Tt

2. Create a Punnet square and put one parent's gametes down the side & the other's across the top.

Dad →	T	t ← Mom
T	TT	Tt
t	Tt	tt

3. Determine all the possible genotypes & phenotypes. Then count how many there are of each in your Punnet square.

genotypic ratio: 1 TT : 2 Tt : 1 tt

phenotypic ratio: 3 Tall : 1 short

Additional Example Problems:

1. Hitchhiker's thumb is dominant to normal thumbs in humans. A homozygous dominant person mates with a heterozygous person. What is the likelihood that their children will have a hitchhiker's thumb?

parents: HH x Hh

	H	H
H	HH	HH
h	Hh	Hh

100% will have hitchhikers Thumb.

2. Spots are dominant to solid fur color in dogs. A spotless dog is mated with a homozygous spotted dog. What are the genotypic and phenotypic ratios of the potential offspring?

Parents: ss x SS

	s	s
S	Ss	Ss
S	Ss	Ss

genotypic ratio: 100% Ss phenotypic ratio: 100% spotted

Gregor Mendel and Working Backwards Notes

Learning Goals:

1. *I can explain Mendel's contributions to genetics.*
4. *I can determine parental genotypes if provided parental and offspring phenotypes.*
5. *I can set up a test-cross to determine a parent's genotype.*

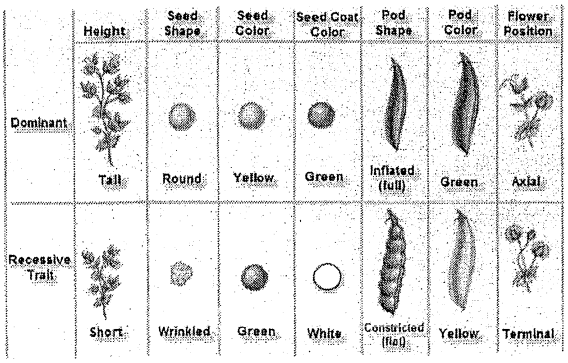
About Gregor Mendel

- Austrian monk, born in 1822.
- Studied math & science & became a teacher at the church
- In charge of the monastery gardens.
- Began to scientifically study the heredity of the garden's pea plants.
- Mendel was not provided with genotypes. Nobody knew what genes were.
- He had to work backwards, using only phenotypes of parents and offspring.
- Known as "Father of Genetics".

Mendel determined dominance through test-crosses

Working Backwards like Mendel

Seven pea plant traits studied by Mendel: Height, Seed shape, Seed color, Seed coat color, Pod shape, Pod color & Flower position



Determining Parent & Offspring Genotypes Knowing Dominance:

1. Yellow seeds are dominant to green seeds. Two yellow-seeded plants were mated and 3/4 of the offspring were yellow and 1/4 were green.
   a. What are the parent's possible genotypes?

      Yy x Yy

   b. What are the offspring's possible genotypes?

      YY, Yy or yy

	Y	y
Y	YY	Yy
y	Yy	yy

3/4 yellow

1/4 green

2. Tall plants are dominant to short plants. Two tall plants were mated and all of the offspring were tall.
   a. What are the parent's possible genotypes?

      TT x Tt or TT x TT

   b. What are the offspring's possible genotypes?

      TT or Tt

3. Round seeds are dominant to wrinkled seeds. A round-seeded pea plant was mated with a wrinkle-seeded pea plant. All of the offspring had round seeds.
   a. What are the parent's possible genotypes?

      RR x rr

   b. What are the offspring's possible genotypes?

      Rr

Determining Parent & Offspring Genotypes Without Knowing Dominance:

4. A grey fruit fly is mated with a black fruit fly. All offspring are grey; none are black.
   a. Which characteristic is dominant?

      Grey

   b. What are the parent's possible genotypes?

      GG x gg

   c. What are the offspring's possible genotypes?

      Gg

5. Two wire-haired dogs are mated. Three-fourths of the offspring are wire-haired and 1/4 of the offspring are smooth-haired.
   a. Which characteristic is dominant?

      wire-haired

   b. What are the parent's possible genotypes?

      Ww x Ww

   c. What are the offspring's possible genotypes?

      WW, Ww or ww

6. Two white-fruited squash plants are mated. All the offspring are have white fruit; none have yellow.
   a. Which characteristic is dominant?

      Unknown

   b. What are the parent's possible genotypes?

      AA x aa

   c. What are the offspring's possible genotypes?

      Aa

Setting Up Your Own Test Cross To Determine Parental Genotypes:
To determine a whether a parent is homozygous dominant or heterozygous, mate it with an individual showing the recessive trait. (Ex – Mate a tall pea plant (TT or Tt) with a short pea plant (tt).

7. In cats, tabby coloration is dominant over black coloration.
   a. What are the possible genotypes of a tabby cat?

      Tt or TT

   b. To determine a tabby cat's genotype, what type of cat should it be mated with?

      black

   c. If the tabby cat is TT, then the offspring's phenotypic outcome should be:

      100% Tabby

Non-Mendelian Inheritance Patterns Notes

   d. If the tabby cat is Tt, then the offspring's phenotypic outcome should be:

Learning Goal:

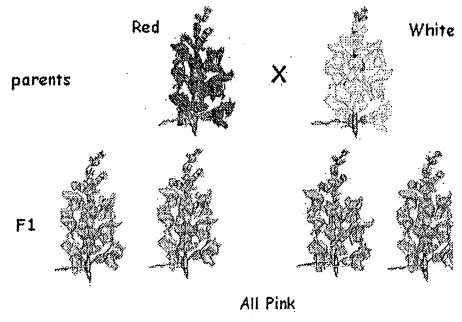
3. *I can determine the possible offspring genotypes and phenotypes of a monohybrid cross using non-Mendelian inheritance patterns (codominance, incomplete dominance & multiple alleles).*

A Mendelian Inheritance Pattern:

- One allele is expressed or has dominance over the other
- To show the recessive trait, an individual must have 2 recessive and 0 dominant alleles.
- Named this way because all of Mendel's pea plant traits displayed this pattern.

Non-Mendelian Inheritance Patterns:

1. **Incomplete dominance:** The two homozygous phenotypes are blended to create the heterozygous phenotype.
   - Example: Snapdragon coloration
     Homozygous phenotypes: Red + White
     Heterozygous phenotype: Pink

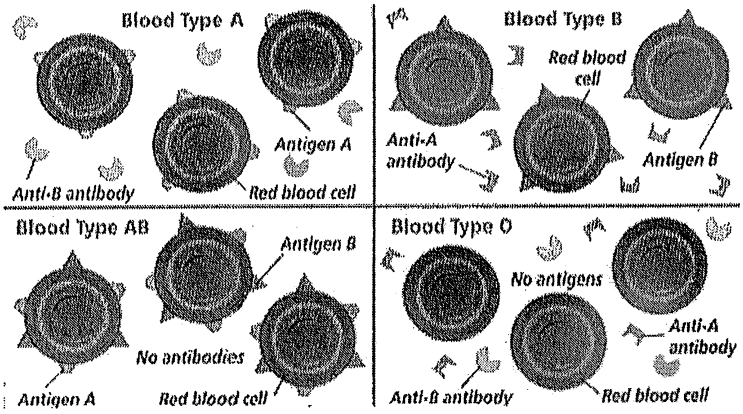


   - Example: Human hair curliness
     Homozygous phenotypes: Curly + Straight
     Heterozygous phenotype: Wavy

2. **Codominance:** Both homozygous phenotypes are Clearly visible (but usually on different parts of the individual).
   - Example: AB Blood type – A & B refer to the types of antigens (proteins or carbs) found on red blood cells.

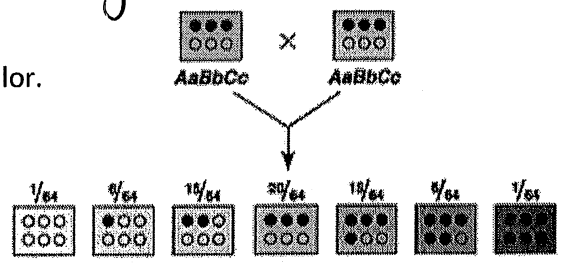
   OR
   - Red + White → Red + white speckled

3. **Multiple Alleles:** For some genes, there exist 3+ for the same gene in the population.
   - Example: Blood type - Three possible alleles:



Genotype	Phenotype
AA	A antigens only
AO	A antigens only
BB	B antigens only
BO	B antigens only
AB	A & B antigens
OO	No Antigens

4. **Polygenic trait:** A trait that is controlled by many different genes.
   - Examples: human skin color, height, & eye color.



The Law of Independent Assortment Notes

Learning Goal:

8. *I can explain the law of independent assortment and its effects on allele combinations.*

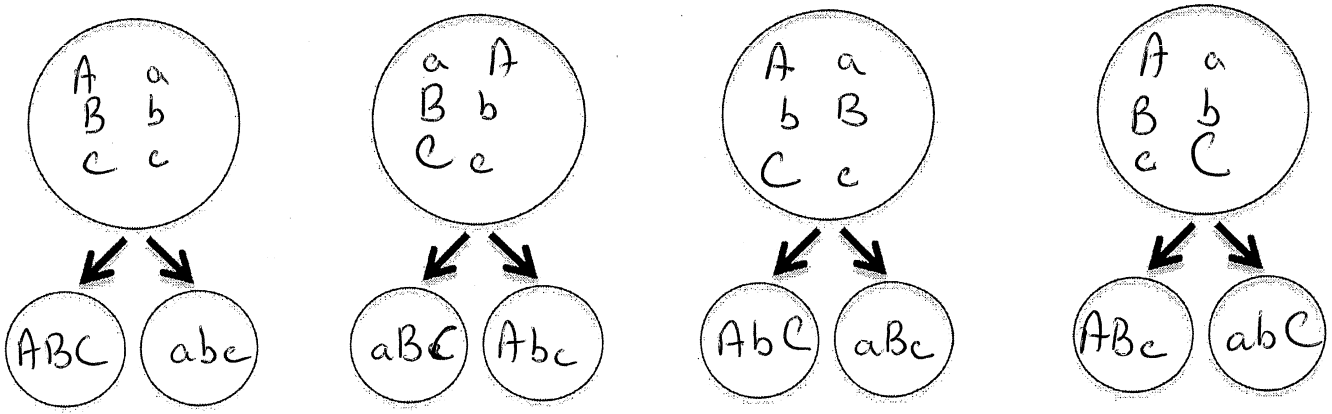
Review:

- When are homologous chromosomes paired up in Meiosis? Prophase 1
- When are homologous chromosomes separated in Meiosis? Anaphase 1
- Do you think that homologous chromosomes line up in Metaphase I exactly the same each time? For example, with Mom's chromosome on the left and Dad's on the right for each tetrad? No

Importance of Independent Assortment

- Each time tetrads line up in Metaphase I, it is random which chromosome will be on the left or the right for Each pair of homologous chromosomes.
- Therefore, when Meiosis is complete, the 4 daughter cells produced will be different than any other time the organism has done Meiosis previously.
- The more chromosomes an organism has, the more potential for variety among the daughter cells
- Genetic variation is important evolutionarily for the survival of species; therefore it is a desirable result of Meiosis.

Modeling Independent Assortment: *Draw a cell in Metaphase I with 3 pairs of homologous chromosomes. Represent one chromosome with a capital letter and the other with a lower case letter (A and a, B and b, C and c). Draw as many different versions of their assortment in Metaphase I as you can. When the top row of cells is complete, write the allele combinations in the gamete cells found below.*



***Remember that these chromosomes are doubled – containing identical sister chromatids, so the result of telophase II will be two more cells that are identical to the ones you wrote above (neglecting crossing over)*

Law of Independent Assortment

- States that: chromosomes for different traits will line up and separate independently of one another when gametes are formed.
- Mendel discovered this Law when he followed two traits in the same few generations of pea plants.
- He found that different traits would appear independently of one another – a plant could be dominant for height but recessive for pod color and vise versa.

The Dihybrid Cross

Learning Goal:

6. *I can determine the possible allele combinations for a dihybrid cross.*
7. *I can determine the possible offspring phenotypes of a dihybrid cross.*

The Dihybrid cross

A dihybrid cross predicts the likelihood that two traits exist in an offspring at the same time. In this activity, the two traits you'll be using will be:

- Plant height – Tallness (T) is dominant to shortness (t).
- Flower color – Red flowers (R) are dominant to white flowers (r).

Example Problem

Two plants that are heterozygous for both plant height and flower color are mated. What are phenotypic ratios of their possible offspring?

Steps to Solve Problem:

1. Determine genotypes of parents.
   a. Parent #1: TtRr
   b. Parent #2: TtRr
2. Determine the allele combinations for each parent's gametes. (You do not need to put them in egg and sperm circles each time – this is just to help remind you of independent assortment).
   a. Parent #1: TR tR Tr tr
   b. Parent #2: TR tR Tr tr

3. Create a Punnet square large enough for all the gametes (one parent down the side & one across the top)

	TR	tR	Tr	tr
TR	TTRR	TtRR	TTRr	TtRr
tR	TtRR	ttRR	TtRr	ttRr
Tr	TTRr	TtRr	TTrr	Ttrr
tr	TtRr	ttRr	Ttrr	ttrr

4. Determine all of the possible phenotypes (remember - there are two traits) and count how many there are of each in your Punnett Square (it is helpful to put a line through them as you go).

Tall : Red : 9
Tall : White : 3
Short : Red : 3
Short : White : 1

Example Problem

Two plants are mated. The first plant is heterozygous for height and homozygous recessive for flower color. The second plant was homozygous dominant for height and heterozygous for flower color. Using the steps provided for the first example problem determine the phenotypic ratio of the offspring for this cross.

1st Plant: Ttrr Allele combinations: Tr tr
2nd Plant: TTRr Allele Combinations: TR Tr

	Tr	tr
TR	TTRr	TtRr
Tr	TTrr	Ttrr

Tall : Red : 2
Tall : White : 2
Short : Red : 0
Short : White : 0