December 18, 2013

Ch. 9

Genetics terms - see handout

Gregor Mendel "Father of Genetics"

Laws of Inheritance

1. Law of Dominance - one gene in a pair can prevent the other gene from being expressed
2. Law of Segregation - alleles separate when gametes (sex cells) are formed (during meiosis)
3. Law of Independent Assortment - gametes may contain dominant AND recessive alleles (separate in meiosis)

Name _____ Class _____ Date _____

Critical Thinking Diagram Worksheet 8-1

Monohybrid Cross
(seed color)

	Y	y
Y		
Y		

Key: Y = yellow
y = green

Dihybrid Cross
(height and seed shape)

	TR	Tr	tR	tr
TR				
Tr				
tR				
tr				

Key: T = tall
t = short
R = round
r = wrinkled

Complete the following.

1. Complete the Punnett square for the monohybrid cross.
2. Complete the Punnett square for the dihybrid cross.
3. Circle the allele of the parent that is heterozygous for seed color in the monohybrid cross.
4. How does a monohybrid cross differ from a dihybrid cross? _____
5. In pea plants, is yellow or green seed color dominant? _____
6. In pea plants, are round or wrinkled seeds dominant? _____
7. Write the genotypes of the offspring that result from the monohybrid cross shown. _____
8. Write the phenotypes of the offspring that result from the monohybrid cross shown. _____
9. How many homozygous yellow offspring will result from the monohybrid cross? _____
10. How many heterozygous yellow offspring will result from the monohybrid cross? _____
11. How many of the offspring produced in the dihybrid cross will be homozygous tall? _____
12. How many of the offspring produced in the dihybrid cross will be heterozygous round? _____
13. Write the phenotypes that result from the dihybrid cross. _____
14. Explain the difference between a phenotype and a genotype. _____

GENETICS PRACTICE PROBLEMS

Name _____

1. In a particular plant, there are two alleles for the gene which controls flower color. One produces orange flowers, and the other yellow. A homozygous orange plant is crossed with a homozygous yellow plant. All of the offspring are yellow flowered. Which allele is dominant?

2. What is a good symbol for the orange allele? _____

3. What is a good symbol for the the yellow allele? _____

4. Two members of the F_1 from the first cross are crossed. Make a Punnett Square which shows this cross.

5. What is the expected genotypic outcome of this cross?

6. What is the expected phenotypic outcome of this cross?

7. What is a good symbol for the alleles which produce axial and terminal flowers in pea plants? (Check your book)

axial _____ terminal _____

p.167

8. Make a Punnett square than shows a cross between 2 axial flowered plants -- one homozygous, the other heterozygous.

9. What is the expected genotypic outcome?

10. What is the expected phenotypic outcome?

GENETICS PROBLEM SET II

A gray dog is homozygous for the trait which produces coat color. The gray dog is mated with a brown dog. The dogs have numerous offspring which are all of the gray phenotype.

1. What is the dominant allele for the trait of coat color? _____
2. What is a good symbol for the gray allele? _____ Brown allele? _____
3. What is the probability that the two dogs above will have a brown pup? _____
4. Two members of the F_1 are crossed. Make a Punnett square to show this cross.

5. What is the expected genotypic outcome of this cross?

6. What is the expected phenotypic outcome of this cross?

7. You have just calculated the probability of the two dogs in #4 having a brown pup. Let's say that they have a brown puppy. On the next birth, what are the odds of having a brown pup? _____

8. Calculate the probability that they will have three brown pups in a row. _____

~~9. Calculate the probability that these two dogs will have at least one brown puppy in three births. Remember that there are several birth outcomes that will give us at least one brown puppy. (Hint. There is only one birth outcome that will not give us at least one brown puppy.)~~

10. A brown dog mates with a gray dog and has five gray pups. What is the genotype of the brown dog?

11. What is most likely the genotype of the gray dog? _____

12. A heterozygous dog mates with a brown dog. What is the probability that these two will have five gray pups in a row?

Types of Inheritance

Single gene
- 1 gene
- 2 alleles
- 2 forms of the trait
  - ex: T = tall t = short
  - R = round r = wrinkled

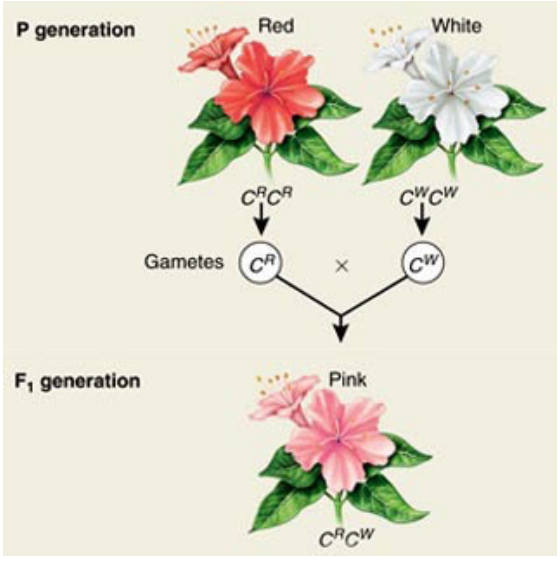
Dominant allele totally hides recessive
- a.k.a. complete dominance

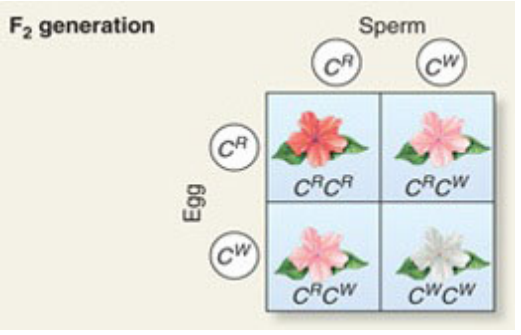
INCOMPLETE DOMINANCE

- 2 alleles- both influence the phenotype
- neither is completely dominant or reces
- alleles BLEND to make an intermediate phenotype
- alleles written in superscript (no lowercase)

ex: Four o'clock flowers

alleles	genotypes	phenotypes
F^R=red	F^RF^R	red
F^W= white	F^WF^W	white
	F^RF^W	pink


P generation
Red
White
C^RC^R
C^WC^W
Gametes
C^R
×
C^W
F_1 generation
Pink
C^RC^W


F_2 generation
Sperm
C^R
C^W
Egg
C^R
C^W
C^RC^R
C^RC^W
C^RC^W
C^WC^W

CODOMINANCE

- 2 alleles- both are expressed in heterozygous individuals
- neither is completely dominant or recessive
- alleles DO NOT blend

ex: "Roan" cattle or horses

alleles	genotypes	phenotypes
C^R=red	C^RC^R	red
C^W= white	C^WC^W	white
	C^RC^W	roan

What type of inheritance do you see in this Rhododendron?

Complete dominance, incomplete dominance or codominance??

MULTIPLE ALLELES- more than 2 alleles in the population

Human Blood Type- example of multiple alleles, along with dominance & codominance

alleles- I^A, I^B and i (sometimes written i^o)

Genotype	Phenotype

e.g.o expected genotypic outcome

e.p.o " phenotypic outcome

ratios or percentages

Practice Problems in Incomplete Dominance and Codominance

Name _____

In the four-o-clock plant, there are two alleles -- red and white. In heterozygous individuals, the phenotype is pink.

1. Show a cross between red and white flowered plants. Give the expected genotypic and phenotypic outcomes.

2. Show a cross between two members of the F_1. Give the expected genotypic and phenotypic outcomes.

In one gene in cattle, there are two alleles which control the trait of coat color -- red and white. These alleles are codominant and in heterozygous animals, the phenotype is called "roan" -- roan individuals have both red and white hairs.

3. Show a cross between a red bull and a white cow. Give the expected genotypic and phenotypic outcomes.

4. Show a cross between two members of the F_1. Give the e.g.o. and e.p.o.

In humans there are protein markers on the outside of our blood cells which are controlled by a gene that has three alleles. I^A produces the A type protein, I^B produces the B protein, while i does not produce any protein.

1. Show a cross between a person with the genotype I^Ai and I^AI^B. Give the e.g.o. and the e.p.o. of this cross.

2. What is the probability that a person with O blood and a person with AB blood will have an offspring with:
   - A Blood
   - B Blood
   - AB Blood
   - O Blood

POLYGENIC INHERITANCE *(Ch. 12)*

- "many genes"
- traits determined by several **sets** of genes
- phenotypes have many degrees of variation

ex: eye, hair and skin color
shape of eyes, ears, nose, etc.

NOW... ONE LAST TYPE OF INHERITANCE!

http://www.youtube.com/watch?v=H1HaR47Dqfw

SEX-LINKED TRAITS

- alleles are found only on X chromosome *(not present on Y)*
- shows up more in males because females can b carriers *(heterozygous)*
- genotype uses XX *(female)* or XY *(male)* with superscript allele

ex: Muscular dystrophy *(recessive disorder)*

alleles	genotypes	phenotypes
D= normal	X^DX^D	
d= M.D.	X^DX^d	
with	X^dX^d	
XX or XY	X^DY	
	X^dY	

H = normal
h = hemophilia

B = normal
b = colorblind

X^H X^h

X^b Y ← no second gene

GENETICS PROBLEM SET -- SEX-LINKED TRAITS

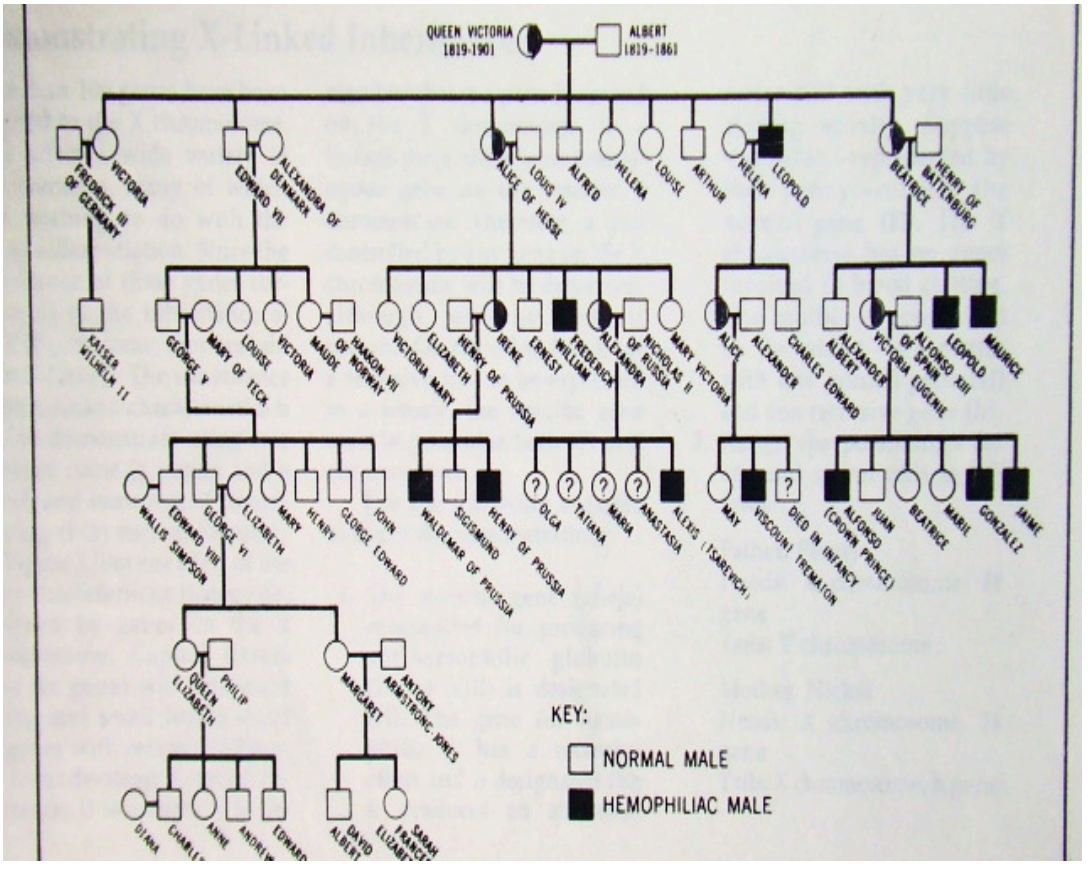
H=normal
h=hemo.

1. Hemophilia is a recessive sex-linked trait that was common among the royal families of Europe during the 19th century when inbreeding among royal families was common. Show a cross between a normal male and a female who is heterozygous. What are the expected genotypic and phenotypic outcomes for this cross? How could you get a female with the disease?

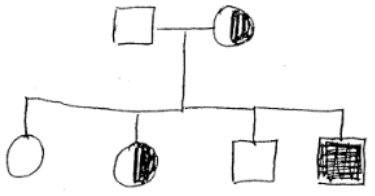
B=normal
b=colorblind

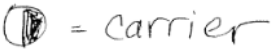
2. Colorblindness is also sex-linked. Show a cross between a colorblind male and a homozygous normal female. What are the expected outcomes?

3. Is a colorblind female possible? How could one occur? Colorblind females are more common than hemophiliac females. What could explain this difference?

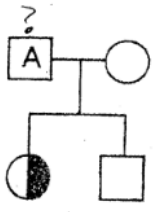

QUEEN VICTORIA
1819-1901
ALBERT
1819-1861
VICTORIA
FREDERICK III OF GERMANY
ALEXANDRA OF DENMARK
EDWARD VII
ALICE OF HESSE
LOUIS IV
ALFRED
HELENA
LOUISE
ARTHUR
HELENA
LEOPOLD
HENRY OF BATTENBURG
BEATRICE
KAISER WILHELM II
GEORGE V
MARY OF TECK
LOUISE
VICTORIA
MAUDE
HAAKON VII OF NORWAY
VICTORIA MARY
ELIZABETH
HENRY OF PRUSSIA
IRENE
ERNEST
FREDERICK WILLIAM
ALEXANDRA
OF RUSSIA
NICHOLAS II
MARY VICTORIA
ALICE
ALEXANDER
CHARLES EDWARD
ALEXANDER ALBERT
VICTORIA EUGENIE
ALFONSO XIII OF SPAIN
LEOPOLD
MAURICE
EDWARD VIII
WALLIS SIMPSON
GEORGE VI
ELIZABETH
MARY
HENRY
GEORGE EDWARD
JOHN
WALDEMAR OF PRUSSIA
SIGISMUND
HENRY OF PRUSSIA
OLGA
TATIANA
MARIA
ANASTASIA
ALEXIS (TSAREVICH)
MAY
VISCOUNT TREMATON
DIED IN INFANCY
ALFONSO (CROWN PRINCE)
JUAN
BEATRICE
MARIE
GONZALEZ
JAIME
QUEEN ELIZABETH
PHILIP
MARGARET
ANTONY ARMSTRONG-JONES
KEY:
NORMAL MALE
HEMOPHILIAC MALE

Pedigrees for **sex-linked traits,** *such as colorblindness or hemophilia*, show if the female is hiding a recessive gene. She is called a carrier if she is normal, but is carrying the recessive (diseased) gene on her second X chromosome. Here is an example of how a carrier would be shown on a pedigree:





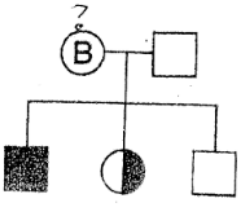
Each of the pedigrees below shows the inheritance pattern of a sex-linked disorder, such as color blindness. Answer the question below each pedigree.



1. Is the father, A, affected or not affected by the disorder? Explain your answer. _____

_____

_____



2. Is the mother, B, affected by the disorder, not affected, or a carrier? Explain your answer.

_____

_____

_____