GENETICS REVIEW

Key

Review Pages 270- 320 in your biology book.

Topics to Remember:

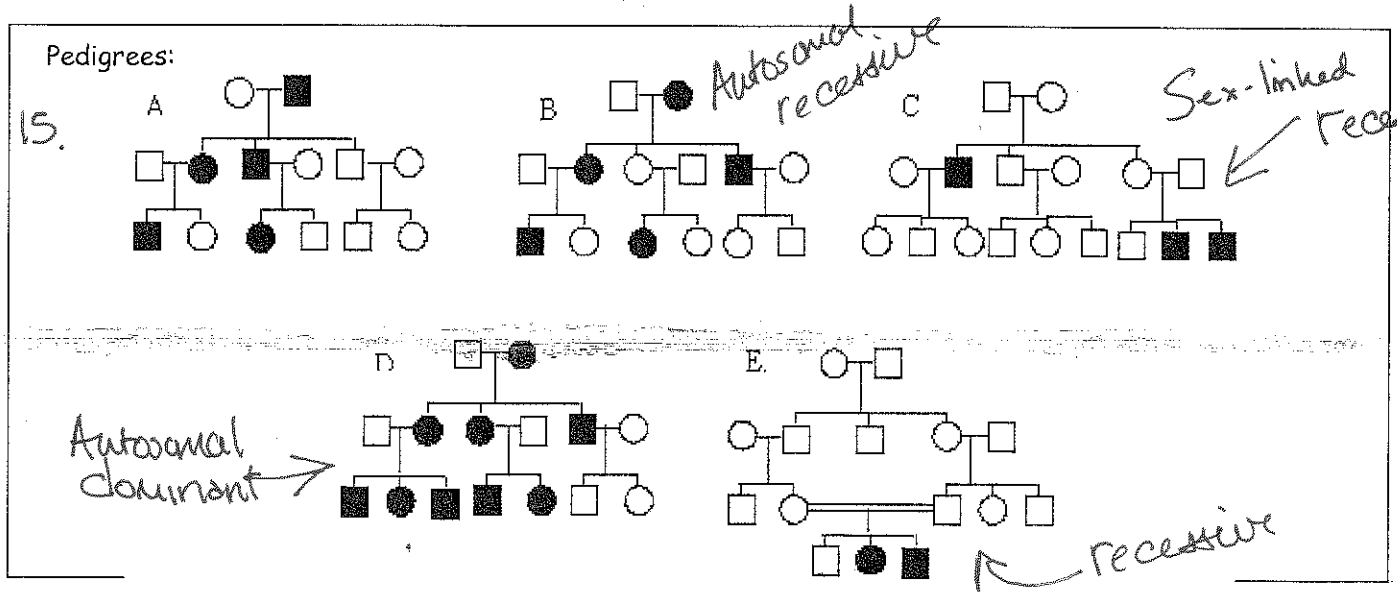
Allele combinations
Autosomal Traits
Blood Types
Codominance
Dihybrid cross
Dominance
epistasis
Hemophilia
Heterozygous
Homozygous Dominant
Homozygous Recessive
Hybrid
Incomplete dominance
Karyotype
Mendel
Monohybrid cross
mutation
Pedigree
phenotype
Polyploidy
Recessive
Sex-linked traits
Sickle Cell Anemia
True breeding

Questions to answer to help you prep:

1. Who is Gregor Mendel?
   - Define Mendel's principles:
   - Law of independent assortment
   - Law of segregation
   - Law of dominance
2. Draw a picture that shows how alleles segregate and recombine during gamete formation:
3. Where are genes located?
4. What is the human genome project?
5. How can a karyotype be used to determine if someone has a genetic abdormality?
6. What is the difference between genes and alleles?
7. What are the possible blood types for humans?
8. What are the possible genotypes for a person that has type B blood?
9. Can a couple that both have o blood have a child with type a blood?
10. What is an example of a trait that is sexlinked?
11. What is an example of incomplete dominance?
12. Draw a picture that shows the two chromosomes of an individual that has pink flowers (Rr).
13. What are autosomal chromosomes?
14. How many sex chromosomes does an individual have?

Pedigrees:

15.



- Which of the above pedigrees probably depicts a sex-linked trait?
- Which of the pedigrees probably depict a recessive trait?
- Which of the pedigrees depict an autosomal trait?
- If Pedigree "A" shows which individuals in the family have freckles. Freckles is an autosomal dominant trait. What are the parents phenotypes in this pedigree?
- What are their genotypes?

16 • Axial flower position (A) is dominant to terminal flower position (a) in pea plants; likewise, red flowers (R) are dominant to white flowers (r). What are the possible outcomes in the following cross: AaRr x aarr?
- What are the chances that their offspring have terminal red flowers?

17 • What is the maximum number of allele combinations you can get from a cell containing the following genotype: Aa Bb Cc?

18 • If a man with type A blood marries a woman with type O blood, what are the chances they will have a daughter that has O blood?

19 • If a breeder wanted to discover whether a dog has normal hearing homozygous (HH) or heterozygous (Hh), the animal in question would need to be crossed with an individual that has which type of genotype?

20 • In the cross TtSs x TtSs, what is the probability that their offspring will be tall and smooth?

• How many alleles for each trait are there in a gamete? In a zygote? ← 1 → 2

21 • A man with blood type A is being sued for paternity by a woman with blood type B. The child the woman claims he has fathered has blood type AB. If this man is the father, what are the genotypes of the parents?

22 • What is the chance that a color blind man and a carrier woman will have a child that is colorblind?

23 • What are GMO's and how does the environment affect ones genetic makeup?

24 • Grandfather and Grandmother Smith smiled a lot and showed off their dimples each time. They had a son named John, who had dimples, and daughter named Julie, who did not. Julie died at an early age, but her brother John Smith met and married Mary Jones because she had the most beautiful dimples when she smiled. They had 5 children, 2 boys and 3 girls. Only one of their sons, Tom, had dimples, but both girls, Judy and Kay, had dimpled smiles. Their sister June lacked dimples. After college, Tom met and married Jane Kennedy who also had dimples. They had 3 children, all girls, who shared their parent's dimpled smile. Tom's sister Kay married a lawyer named James who seldom smiled and didn't have dimples. Their only son Matthew was like his mother when he smiled. Judy never married. Tom's sister, June, married a doctor and had 5 children. Three of the children were boys, Jay, Fred, and Mike. Mike and Fred had dimples like dad, but Jay's smile was like his mom's lacking dimples. One sister, Susan, had dimples, but the other, Katherine, didn't.
- Create a pedigree for the Smith family (MAKE A KEY!).

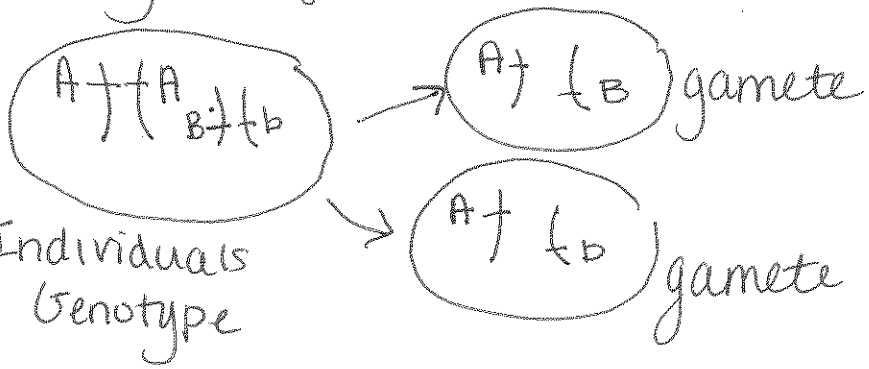
Complete end of chapter problems for practice! *Review your worksheets and notes for extra practice!*

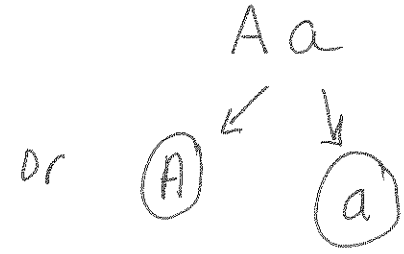
Genetics Review KEY

1) Gregor Mendel (1822-1884)
- Austrian monk
- inheritance experiments with pea plants

Law of segregation - alleles of each parent separate during gamete formation

Law of independent assortment - alleles are passed on to offspring (zygote) independently of one another providing unique combinations

2) 

or 

3) Genes are located on chromosomes.

4) The Human Genome Project is an international effort, started in 2003, to map out/identify all ~24,000 human genes.

5) A karyotype is a picture of all the chromosomes in a somatic cell. This picture can be used to pick out genetic abnormalities.

6) A gene is a segment of DNA that codes for a trait.

An allele is a version of that particular gene.

7) Types: AB, A, B & O

8) BB or Bo (I^BI^B or I^Bi)

9) no (ii x ii)

10) hemophilia or colorblindness

11) Hair type (curly CC v wavy Cc v. straight cc)

12) RfffR

13) non-sex chromosomes

14) two

15) See worksheet

16) AaRr x aarr

AR
Ar
aR
ar

aarr

Phenotypes
Axial Red
Axial white
terminal Red
terminal white

AaRr | Aarr | aaRr | aarr

25% Chance

17) AaBbCc

ABC
AbC
ABc
Abc

aBC
abC
aBc
abc

8 combinations

18)

	A	A
O	AO	AO
O	AO	AO

0%

	A	O
O	AO	OO
O	AO	OO

50% ←

19) homozygous recessive

20) TtSs x TtSs 9/64 chance

21)

	A	A
B	AB	AB
B	AB	AB

or

AO x BO
AA x BO

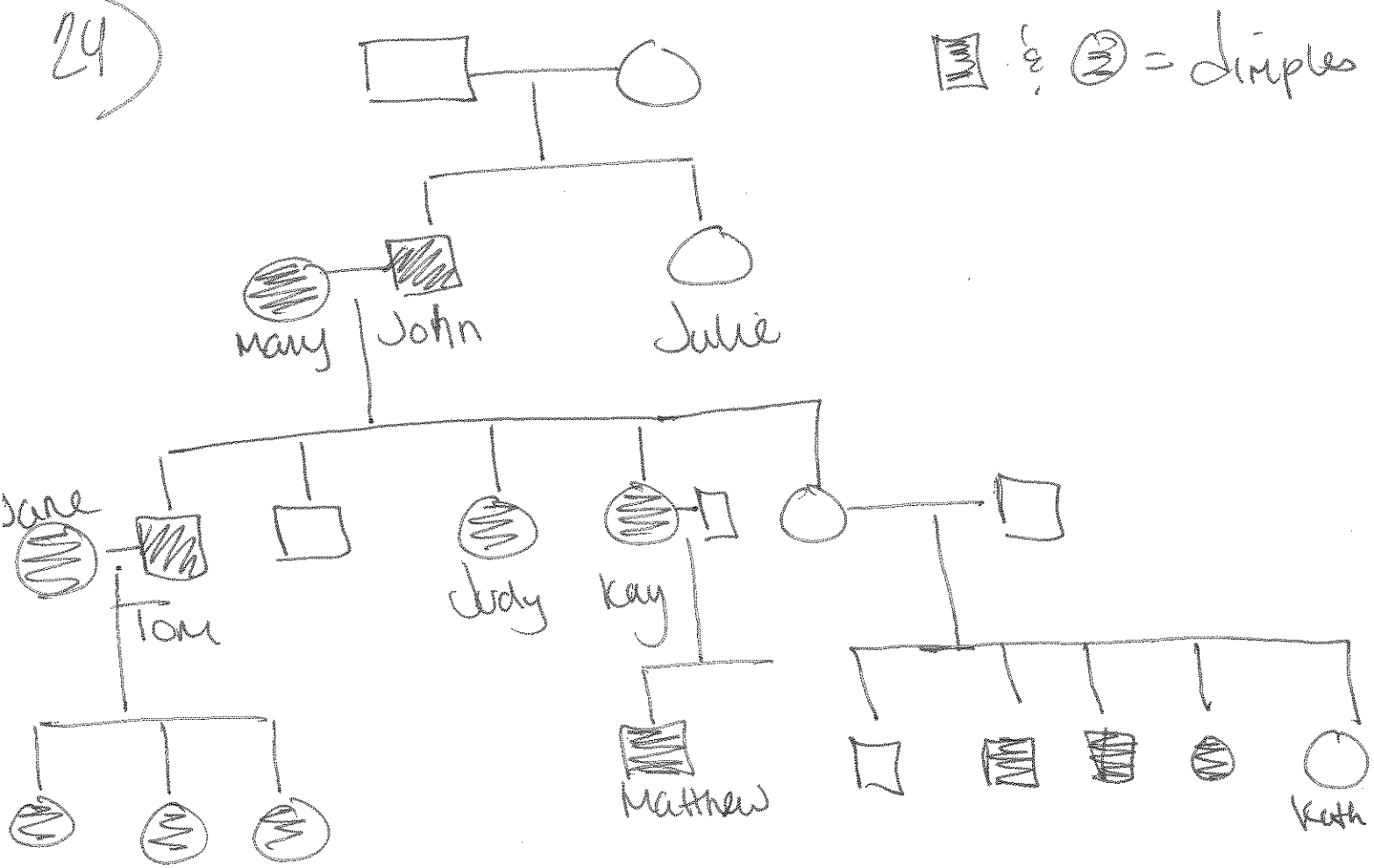
AO x BB
AA x BB

22) $X^cY \times X^CX^c$

X^CX^c	X^cX^c	50%
X^CY	X^cY	

23) genetically modified organisms

24)



Chapter 5

STUDY GUIDE

Use with Text Pages 124–131

What Is Genetics?

KEY

For each item, cross out the phrase or phrases that do not accurately complete the statement.

1. Genes
   a. are made up of DNA.
   b. control the traits that show up in an organism.
   c. are found on chromosomes.
   ~~d. are never inherited by some people.~~
   e. have different forms called alleles.

2. Gregor Mendel
   a. is the Father of Genetics.
   b. lived in Europe in the 1800s.
   c. experimented with peas.
   d. arrived at his conclusions by accident.
   e. determined the basic laws of genetics.
   f. changed the thinking of the scientists of his day.

1822-1884 Austria

3. Alleles
   a. are forms of a gene.
   b. are the subject of genetics.
   c. can be dominant or recessive.
   ~~d. for a trait from both parents are found in one sex cell.~~

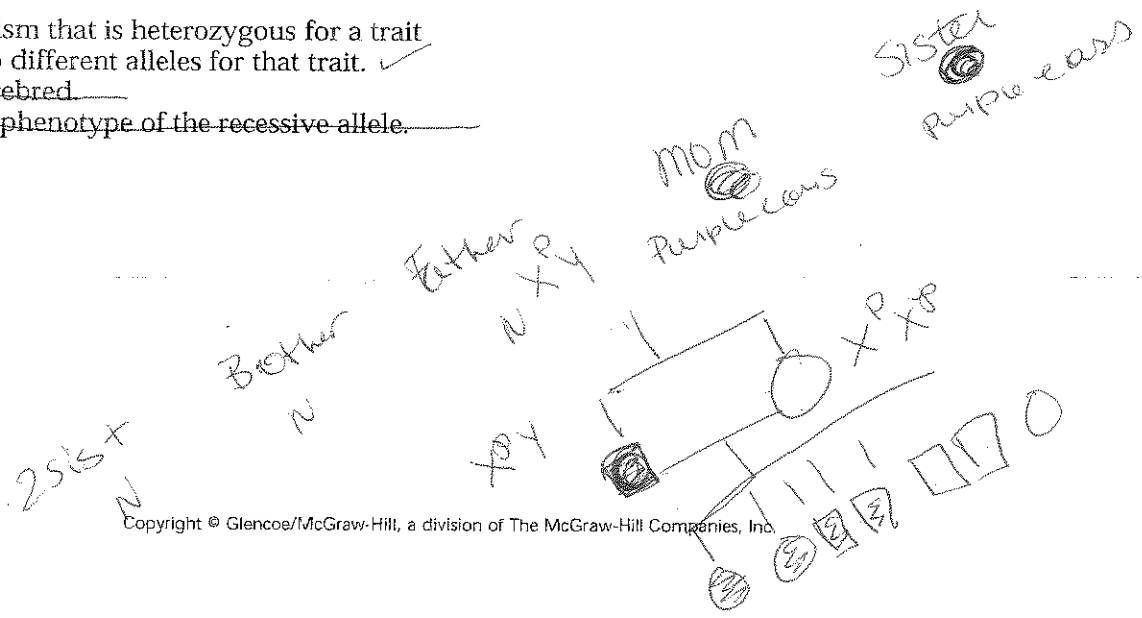
one allele for each trait in a sex cell

4. A Punnett square
   a. is used to predict results in genetics.
   b. represents the genotypes of offspring that can result from the combination of alleles from two parents.
   ~~c. uses numbers to represent the offspring of two or more parents.~~

5. A genotype of an organism
   ~~a. is a physical trait.~~
   b. is its genetic makeup.
   c. determines its phenotype.

6. A recessive factor
   a. can seem to disappear in a generation of organisms.
   ~~b. is represented by a capital letter on a Punnett square.~~
   ~~c. covers, or dominates, a dominant factor.~~

7. An organism that is heterozygous for a trait
   a. has two different alleles for that trait.
   ~~b. is a purebred.~~
   ~~c. has the phenotype of the recessive allele.~~



Chapter 5

STUDY GUIDE

Use with Text Pages 132–136

Genetics Since Mendel

Write the letter of the term or phrase that best completes each sentence.

d 1. When both alleles of a gene are expressed in the offspring, the condition is called _____ .
a. heredity
b. mixing
c. blending
d. incomplete dominance

a 2. An example of incomplete dominance is _____ .
a. a white allele and a red allele in a plant producing pink flowers
b. red flowers crossed with white flowers producing both red and white flowers
c. a red allele covering a white allele in red flowers
d. a dominant pink allele covering recessive red and white alleles

c 3. Because alleles A and B for blood type are inherited by incomplete dominance, a person with genotype AB would have the phenotype _____ .
a. A
b. B
c. AB
d. O

d 4. Because alleles A and B are both dominant and the O allele is recessive, a person with phenotype O would have genotype _____ .
a. AO
b. BO
c. ABO
d. OO

c 5. A person with phenotype O blood could not be the parent of an offspring with phenotype _____ blood.
a. O
b. A
c. AB
d. B

For each item, identify the type of inheritance. Write "multiple allele" or "polygenic" in the blank.

poly 6. A group of genes acts together to produce a single trait.

mult 7. One trait is controlled by more than two alleles of a gene.

mult 8. There are three alleles for human blood type.

poly 9. Up to six gene pairs may control the color of human skin.

poly 10. The effect of a single allele may be small, but the combination of alleles from many genes produces a wide variety in a trait.

poly 11. Human traits such as eye and hair color, height, and weight are controlled by two or more gene pairs.

KEY

Sex-Linked Practice Problems

1. In humans colorblindness (b) is an example of a sex-linked recessive trait. In this problem, a male with colorblindness marries a female who is not colorblind but carries the (b) allele.
Using a Punnett square, determine the genotypic and phenotypic probabilities for their potential offspring.

X^cY X^cX^c

	Genotypic Percents	Phenotypic Percents
male	X^cY	Colorblind
female	X^cX^c	normal carrier

2. In fruit flies red eye color (R) is dominant to white eyes (r). In a cross between two flies, 50% of the male and 50% of the female offspring had red eyes. The other half of the males and females had white eyes. What are the phenotype, and all possible genotypes, of the offspring?

50% Rr or RR

	Genotypic Percents	Phenotypic Percents
male	X^rY	White
female	X^RX^r	Red

Example 3: (*Dihybrid Cross*)

Dihybrid crosses use Punnett squares to distribute parental alleles from *two* genes into gametes (eggs and sperm or pollen and ovum) as would be predicted by meiosis.

➢ In garden peas, tallness (T) is dominant to shortness (t) and axillary flowers (A) are dominant to terminal flowers (a). What are the expected ratios for the genotypes and phenotypes of the offspring if a heterozygous tall, heterozygous axillary plant is crossed with a heterozygous tall, terminal plant?

	TA	Ta	tA	ta
Ta	TTAa tall Aux	TTaa tall term	TtAa tall aux	Ttaa
Ta	TTAa	TTaa	TtAa	Ttaa
ta	TtAa	Ttaa	ttAa	ttaa
ta	TtAa	Ttaa		

Guidelines for Dihybrid Punnett Squares

1. Dihybrid crosses - use the *FOIL* method from the binomial distributive property of multiplication.
   ex: gamete distribution for AaBb:
   AB Ab aB ab
2. Dominant alleles (upper case) are written before recessive allele (lower case) - except for distributing alleles in dihybrid crosses.
3. Alleles of the same gene always stay together (important in dihybrid problems)

Genotypes:

Genotypic Ratios	Phenotypic Ratios
	6:6:2:2

Phenotypes:

Tall Aux	IIII	Short Aux	II
Tall terminall	IIII	Short term	II

3:3:1:1

TtAa x Ttaa

Dihybrid Practice Problems

1. In horses, the coat color black is dominant (B) over chestnut (b). The trotting gait is dominant (T) over the pacing gait (t). If a homozygous black pacer is mated to a homozygous chestnut, heterozygous trotter, what will be the ratios for genotype and phenotype of the F_1 generation?

BBtt x bbTt

Bt bT bt

	bT	bt
Bt	BbTt	Bbtt

Genotypes: BbTt : Bbtt

Phenotypes

Blacktrotter : Black Pacer

Genotypic Ratios	Phenotypic Ratios
1:1	1:1

2. In rabbits, the coat color black dominant (B) over brown (b). Short hair is dominant (S) over long (s). In a cross between a homozygous black short-haired male and a brown homozygous long-haired female, what would be the ratios for genotype and phenotype of the F_1 generation?

BBSS x bbss

BS bs

Genotypes: BbSs

Phenotypes

Brown Short

Genotypic Ratios	Phenotypic Ratios
1:0	1:0

3. Imagine that a couple is planning to have children. The male is heterozygous for Huntington's disease and homozygous dominant for Tay-Sachs. The female is homozygous recessive for Huntington's disease and heterozygous for Tay-Sachs. The couple is curious about the possibility and probability of their offspring inheriting Tay-Sachs and/or Huntington's. For humans, Huntington's disease is dominant (H) over the "normal" condition (h), and the "normal" condition is dominant (T) over Tay-Sachs (t). Complete a Punnett square for this cross and record the probabilities for genotypes and phenotypes of the offspring as ratios.

h = normal H = huntingtons

T = normal t = taysachs

HhTT x hhTt

HT hT

hT ht

	HT	hT
hT	HhTT	hhTT
ht	HhTt	hhTt

Genotypes: HhTT : HhTt : hhTT : hhTt

Phenotypes 1 : 1 : 1 : 1

(huntington Normal)

Normal Normal

Genotypic Ratios	Phenotypic Ratios

Name KEY
Date

Pedigree Charts Worksheet(s)

Background Information:

Pedigree charts are very important to many different fields of science. One reason they are important is because, they help scientists understand the genetic patterns of diseases. It is important to be able to interpret pedigree charts in order to learn the pattern of a disease or condition. Specifically, using a pedigree chart, you can tell if the disease or condition is autosomal, X-linked, dominant, or recessive.

Before you start this activity it is important to review several symbols:

- Unaffected male
- Affected male
- Carrier male
- Unaffected female
- Affected female
- Carrier female

Procedure:

A. First you need to become comfortable in making a pedigree chart. Complete the following examples. You may refer to your notes if necessary.

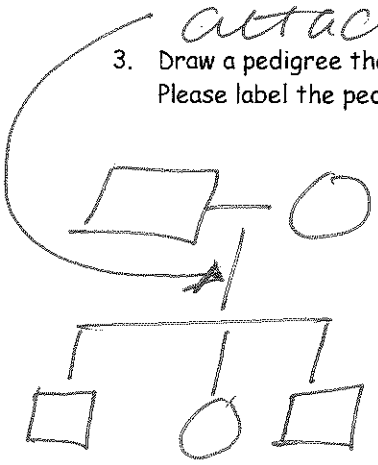
1. How can you tell if a couple is married on a pedigree? Write a one sentence description and draw an example.

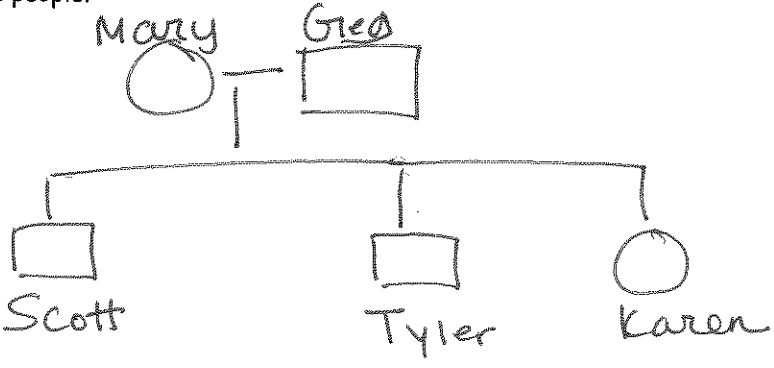
Married individuals are connected by a horizontal line.

2. How can you tell if the couple who is married had children? Write a one sentence description and draw an example.

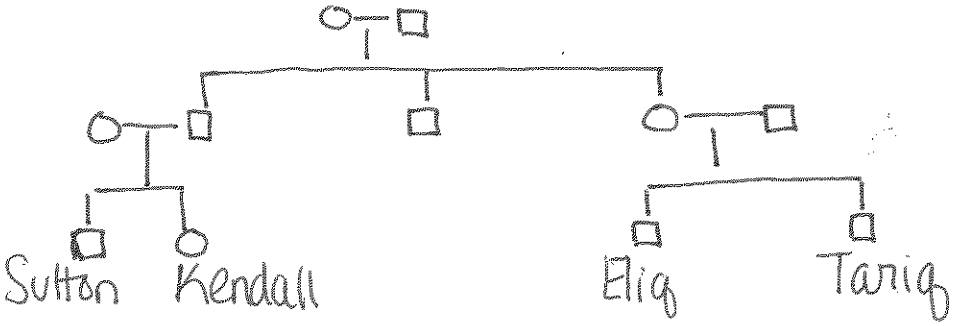
A couple that has had children will have a line that comes off the line that attaches them.

3. Draw a pedigree that represents Mary married to Greg and with 2 sons (Scott and Tyler) and 1 daughter (Karen). Please label the pedigree with the names of the people.

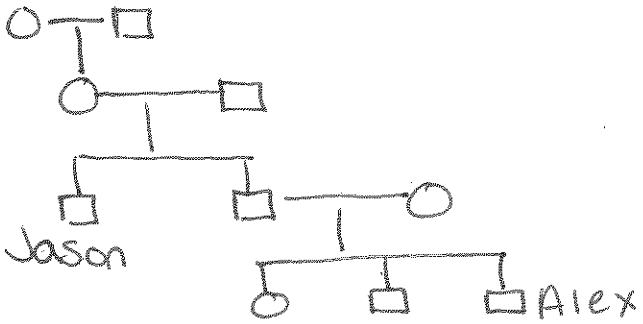




4. Draw a pedigree that represents Mary married to Greg, with 2 sons and 1 daughter. Their son, Scott, married April and had Sutton (a boy) and Kendall (a girl). Their daughter, Karen, married Harry and had Eliq (a son) and Tariq (a son). Please label the pedigree with the names of the people.

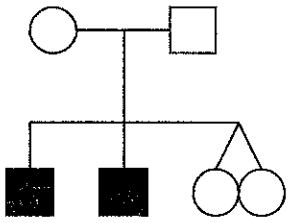


5. Draw a pedigree that represents Julie married to Jeff, with one daughter, Josephine. Josephine married Joseph and had Jason and Joe. Joe married Julia and had Shannon and fraternal twin boys, Mark and Alex. Mark married Alison and had Ray and Scarlet. Please label the pedigree with the names of the people.



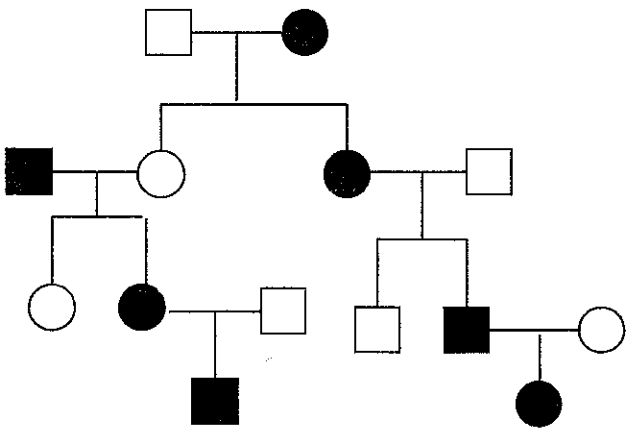
A. Identify the following pedigree charts as autosomal, X-linked, recessive, and dominant. Please explain your answer.

1. Is the following autosomal or X-linked? Is it dominant or recessive? Please explain.



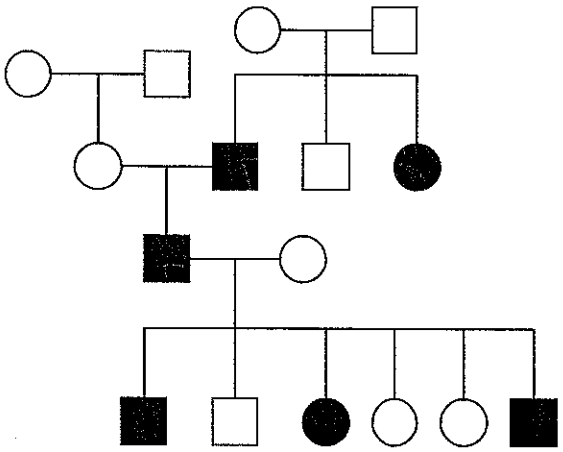
Sex linked recessive

2. Is the following autosomal or X-linked? Is it dominant or recessive? Please explain.



Could be autosomal dominant or recessive

3. Is the following autosomal or X-linked? Is it dominant or recessive? Please explain.

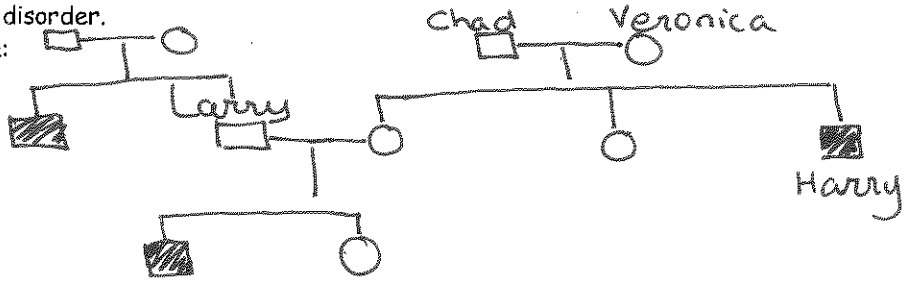


Autosomal recessive

B. Now you must make a pedigree chart from the descriptions given. Tell whether it is autosomal or X-linked and whether it is dominant or recessive. Also, state which type of muscular dystrophy the pedigree could be based off of the list your teacher has given you. Label the pedigree with the names of the individuals.

a. Chad and Veronica got married and had Brittany, Kristin, and Harry. It was discovered that Harry had muscular dystrophy. Brittany married Larry and had Stephan and Stephanie. Stephan also had muscular dystrophy. Larry's brother Barry also had muscular dystrophy but neither of their parents had the disorder.

Draw a pedigree:

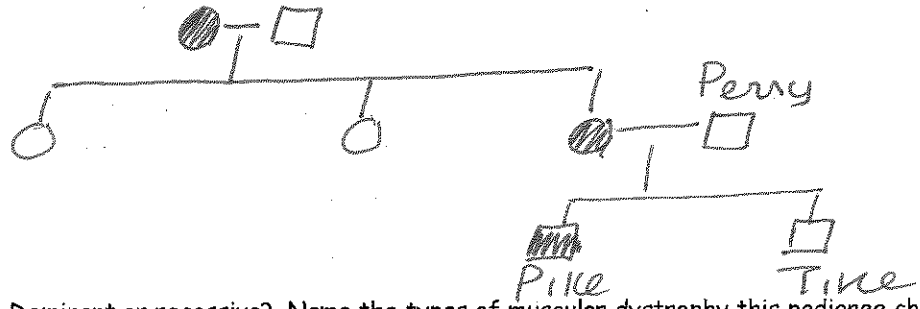


Autosomal or X-linked? Dominant or recessive? Name the types of muscular dystrophy this pedigree chart could represent.

X-linked recessive

b. Lisa and Ashton got married and had three girls, Cari, Mary, and Terry. It was discovered that Lisa had muscular dystrophy. Terry married Perry and had two boys, Pike and Tike. It was discovered that Terry and Pike had muscular dystrophy.

Draw a pedigree:

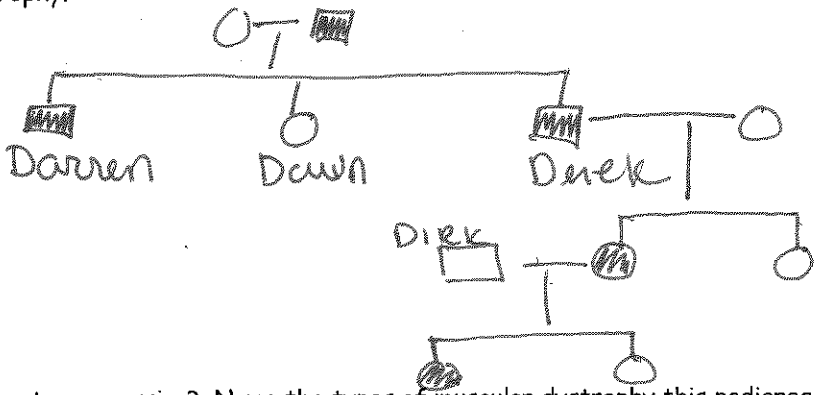


Autosomal or X-linked? Dominant or recessive? Name the types of muscular dystrophy this pedigree chart could represent.

autosomal

c. Debbie married David and had three children, Darren, Dawn, and Derek. David, Darren and Derek discovered they have muscular dystrophy. Derek married Didi and had two children, Denise and Destiny. Denise also has muscular dystrophy and married Dirk. They had two children, Dee and Deven. Dee has muscular dystrophy.

Draw a pedigree:



Autosomal or X-linked? Dominant or recessive? Name the types of muscular dystrophy this pedigree chart could represent.

in order for dirk and denise to have a girl with the disease the disorder must be sex linked dominant or autosomal

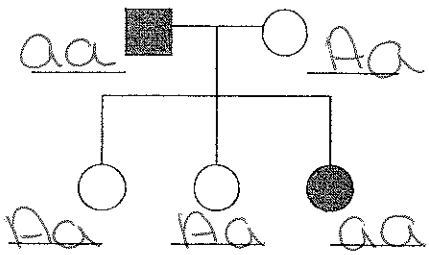
Pedigrees

Name KEY

In humans, Albinism is a recessive trait. The disorder causes a lack of pigment in the skin and hair, making an albino appear very pale with white hair.

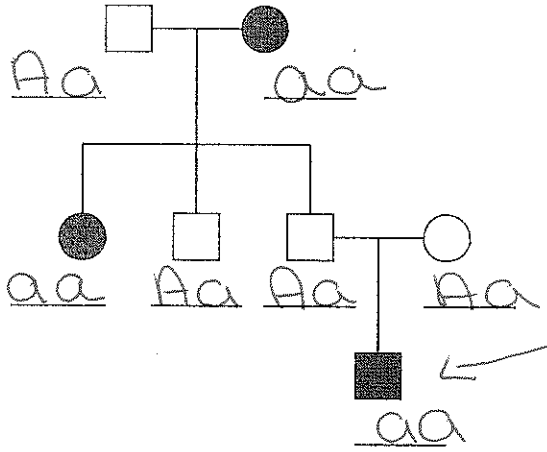
What phenotypes would these genotypes have:

AA = *normal*
Aa = normal
aa = albinism



1. How many children does this family have? 3

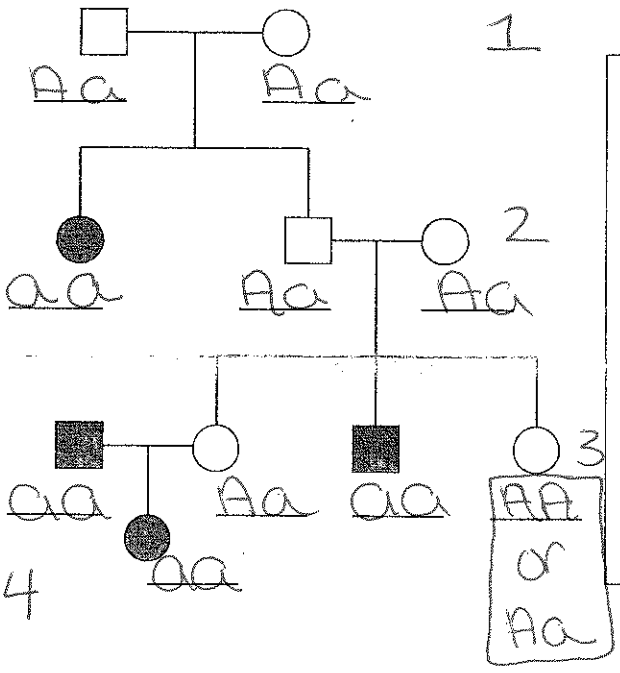
2. What are the sexes of the children?
female



3. How many grandchildren does the original couple have?
1

4. What is the sex of the grandchild?
male

5. How did you know the wife of the youngest son was heterozygous?
bic they have a son that is afected



6. How many generations are depicted in this pedigree?
4

7. How many children does the initial couple have?
2

8. How many great grandchildren does the initial couple have?
1

NAME DATE CLASS

Chapter 20

REINFORCEMENT

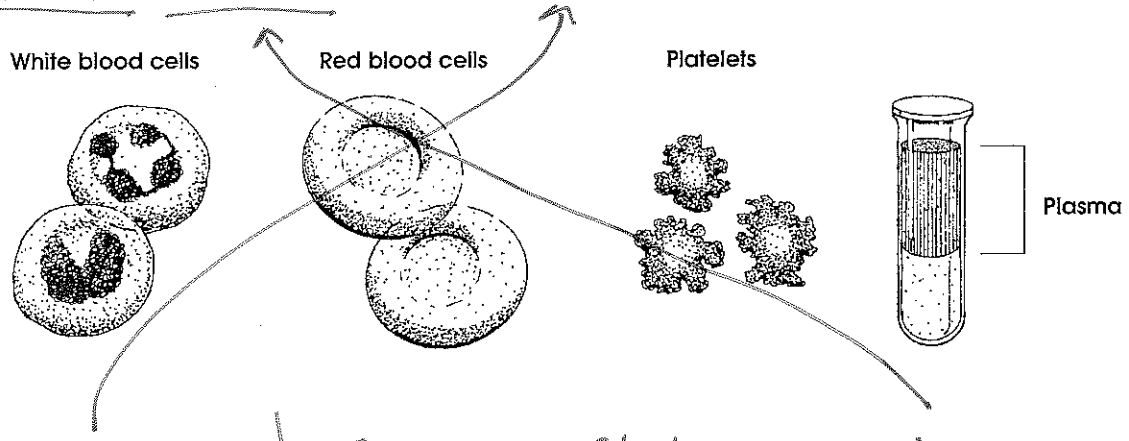
Use with Section 2

• Blood

Fill in the missing words to describe the four functions of blood.

1. carries body Fluid to and removes waste from all body cells
2. carries products of cell activity to lungs to be removed
3. transports nutrients (glucose) from the digestive system to all cells
4. carries materials that fight infections and heal wounds

The parts of human blood are shown below. Write what each part does on the line below its picture: help clot blood; transport oxygen; contains nutrients and minerals; help fight infection.



5. _____ 6. t. O2 7. Clots 8. _____

Complete the following table. Possible blood types of the donor are listed horizontally. The possible blood types of the receiver are listed vertically. Make a check in the box if the receiver can receive blood from the donor directly above. Then answer the questions below the table.

Receiver (can receive blood from) \ Donor (can give blood to)	O	A	B	AB
O	✓			
A	✓	✓		
B	✓		✓	
AB	✓	✓	✓	✓

9. Who can receive any type blood? _____

10. Who can receive only type O blood? _____