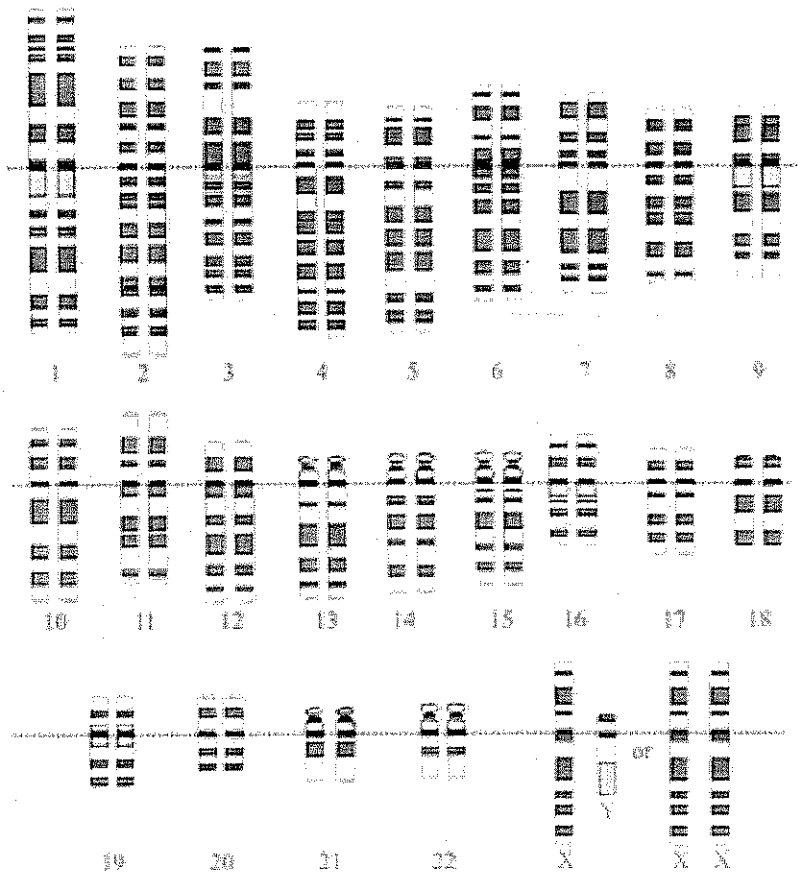
GENETICS PART 1:

Mendelian & Human Genetics



Name: Hour:

WORDS TO KNOW

Genetics
Gamete
Haploid
Allele
Homozygous
Segregation
Monohybrid Cross
Polygenic Inheritance
Turner's Syndrome
Heredity
Fertilization
Zygote
Gene
Heterozygous
Independent Assortment
Pedigree
Incomplete/Complete Dominance
Mendel
Homologous
Autosome
Genotype
Dominant
Codominance
Karyotype
Traits
Diploid
Sex Chromosome
Phenotype
Recessive
Punnett Square
Sex-linked
Down's Syndrome

LEARNING GOALS

After completing this unit you should be able to...

- Explain the significance of Gregor Mendel
- Understand the Laws of Segregation and Independent Assortment
- Describe the difference between homozygous and heterozygous allele combinations
- Compare dominant and recessive alleles
- Predict monohybrid crosses using Punnett Squares
- Predict genotypes and phenotypes based on given information about offspring and parents
- Recognize inheritance patterns and use them in a Punnett square
- Read and interpret karyotypes
- Compare normal chromosome patterns to Down's and Turner Syndrome patterns

Mendelian Genetics

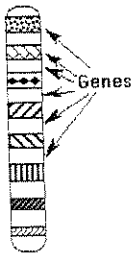
'story

- **Gregor Mendel** conducted the earliest genetic research and in known today as the **"Father of Genetics"** for his many discoveries of genes and inheritance
- He found that **organisms** closely **resembled** their **parents** with slight variations and their characteristics are influenced by **heredity** and the **environment**.

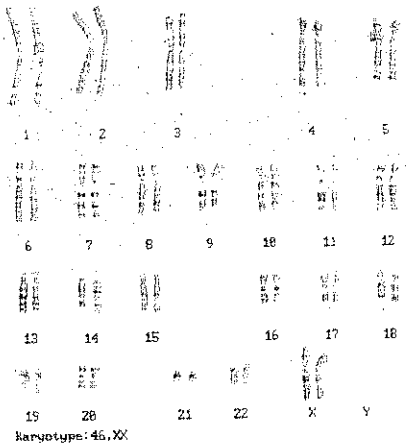
II: **Genetics**

- Branch of biology that studies _____ or the passing on of characteristics from parent to offspring during sexual reproduction

III: **Conclusions made by Mendel:**



1. _____ or physical characteristic are determined by _____ on chromosomes.
   - _____: segment of DNA
     - 1 or more genes can determine a hereditary trait
   - **There are two types of chromosomes**: all having different genes.
     a. _____ chromosomes
     b. _____ chromosomes: _____



2. Genes have alternative forms called _____.
   a. Offspring will receive _____ allele from **mom and dad**
   b. _____ **alleles** determine how trait is expressed

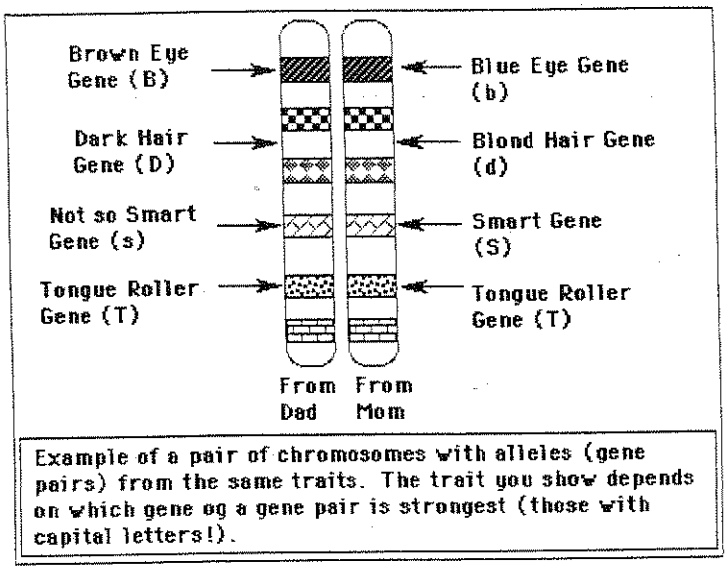
3. **Allele Combinations on each homologous pairs**:

   A. HOMOZYGOUS: _____ alleles that result in a **dominant or recessive** trait.

   B. HETEROZYGOUS: _____ alleles that result in a **dominate** trait
   - **one allele dominant and one that is recessive**
     a. _____: observed or expressed trait
     b. _____: weaker or hidden trait

HOMOLOGOUS PAIRING

NEW GENE COMBINATIONS



Example of a pair of chromosomes with alleles (gene pairs) from the same traits. The trait you show depends on which gene og a gene pair is strongest (those with capital letters!).

IV. Prediction of Traits:

1. _____ used to predict the **probability** or likelihood of a genetic cross

Types of Genetic Crosses:

a. _____: cross that involves _____ **trait** and predicts the **genotype** and **phenotype** of new gene combinations.

A. **GENOTYPE:** The allele combinations of an individual (genetic makeup)

Ex. Trait: Flower color

B. **PHENOTYPES:** physical appearance

Ex. Trait: Eye color

Punnett Square Practice

Stop and Jot Space

Human Genetics

atterns of Inheritance

a. _____

b. _____

c. _____

d. _____

e. _____

a. Complete Dominance:

a. Traits inherited are either _____ or _____

b. Ex. BB, Bb, bb

b. Incomplete Dominance:

- Traits inherited shows a new phenotype that is a _____ or _____ of parental alleles.
  a. _____ results in a "blending" of two alleles
  b. Use both **capital letters** to represent (neither allele is dominant or recessive)

Ex. 4 o'clock flowers, snapdragons, Tay Sach's Disease

c. Codominance:

i. Trait inherited shows a new phenotype that _____ parental alleles

c. _____ condition results in the expression of both alleles

d. Use both **capital letters** to represent

- Ex. Roan Horse (Red and White Hair), Dalmatian fur coat

d. **Sex-Linked Traits**: Human patterns

- traits are controlled by genes carried on the _____or_____ chromosome

a. _____-**linked traits** can be passed onto both **male and female**

b. _____-**linked traits** can be passed on only to **males**

X-Linked Traits:

1. Affect the X chromosome
2. _____ tend to be _____ and pass on traits to their sons
3. Females **can** be affected but _____ chromosomes must have gene for trait

Ex. Color blindness, Hemophilia

e. **Polygenic traits**: Human patterns

- Traits are controlled by _____ gene pairs

a. genes may be on **same** or **different** chromosomes

b. Expressed trait varies greatly

Ex. hair color, eye and skin color, height, weight

II. How to study patterns of inheritance in human families.

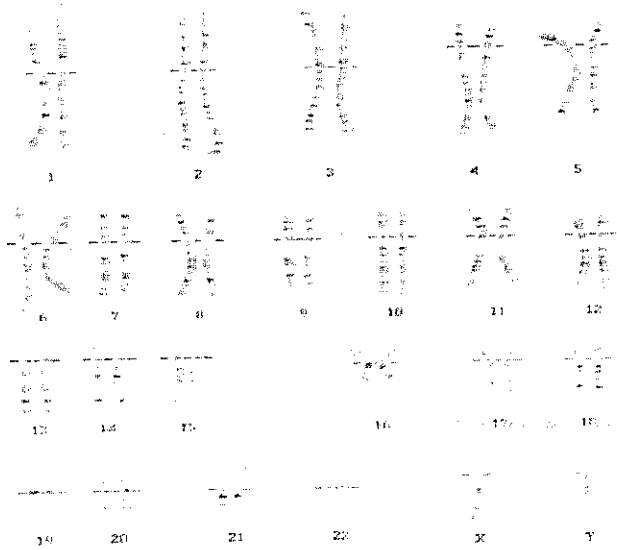
Two Methods:

1. _____: **Photograph** of an individual's chromosomes arranged in **homologous pairs** and can be viewed underneath the microscope.

a. **Used to identify problems with chromosomes**

- Abnormal numbers (non-sex and sex)
- Damaged or broken
- To detect genetic diseases

Typical Karyotype: Normal Individual



2. _____: diagram to show genetic inheritance and is used to map genetic traits.

a. shows _____, _____ and _____ of family members

b. can **predict patterns** of inheritance

c. uses symbols

Codominance & Incomplete Dominance Practice

1. Read each example and determine if it is an example of Codominance (C) or Incomplete Dominance (I)

a. _____ is an example of 2 alleles being expressed

b. _____ is an example of 2 alleles blended or mixed together

2. Above each phenotype listed in each set write the correct genotypes. Remember that the "intermediate" trait must always be heterozygous.

BB YY BY

A wocket in my pocket can be blue, yellow and green - _____

a) _____Birds can be blue, white, or white with blue-tipped feathers.

b) _____Flowers can be white, pink, or red.

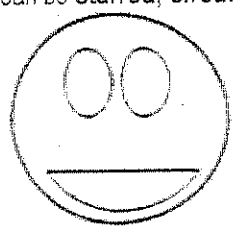
c) _____A Hoo can have curly hair, spiked hair, or a mix of both curly and spiked.

d) _____A Sneech can be tall, medium, or short.

e) _____A Bleexo can be spotted, black, or white.

3. View the smiley pictures below – is this **incomplete dominance or codominance**? Circle

4. In smiley's, eye shape can be **starred, circular, or a circle with a star**. Write the **genotypes** for the pictured phenotypes



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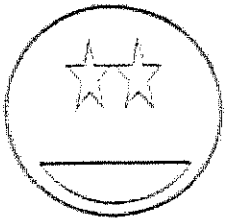

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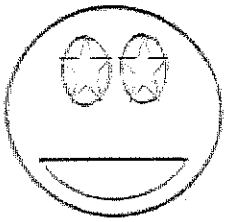


_____

5. **Show the cross between a star-eyed (SS) and a circle eyed (CC).**

What is the phenotype of the offspring? _____

What are the genotypes? _____

6. If the smiley parents produced 1 circle eye(CC), 2 circle-star eye(CS) and 1 star eye(SS) offspring. What are the geneotypes of the parents? Make a punnett square if needed

Parent genotypes: _____and_____

What is the heterozygous phenotype? _____

7. **Show the cross between a circle-star eyed and a circle eyed.**

How many of the offspring are circle-eyed? _____

How many of the offspring are circle-star eyed? _____

How many are star eyed? _____

Practice Punnett Square Problems: Name_____

Problem #1:

In guinea pigs, black fur (B) is dominant. If a heterozygous black guinea pig is crossed with a white guinea pig what are the genotypes and the phenotypes of the offspring.

_____x_____

Genotype:

Phenotype:

Problem #2

If two parents with dominant phenotypes produce an offspring with a recessive phenotype, what does this say about the parents? Explain.

oblem #3

Incomplete dominance problem

If you were to cross pink flowering plants with a white flowering plant, what would the phenotypes and genotypes be of the offspring?

_____x_____

Genotype:

Phenotype:

Problem #4

Codominance Problem

^ dog had offspring with the following phenotypes: ¼ black, 2/4 black and white, ¼ white puppies.

a. Predict the genotypes of the parents? _____ and _____

b. what is the phenotype of the heterozygous offspring? _____

c. what are the genotypes of each offspring? _____

Name _____ Date _____

Sex-Linked Traits

A pair of chromosomes known as sex chromosomes determines the sex of an organism. A male has one X-chromosome and one Y-chromosome. A female has two X-chromosomes. Although the sex chromosomes control the sex of an individual, there are non-sex related traits found on the X-chromosomes that are not found on the Y-chromosomes.

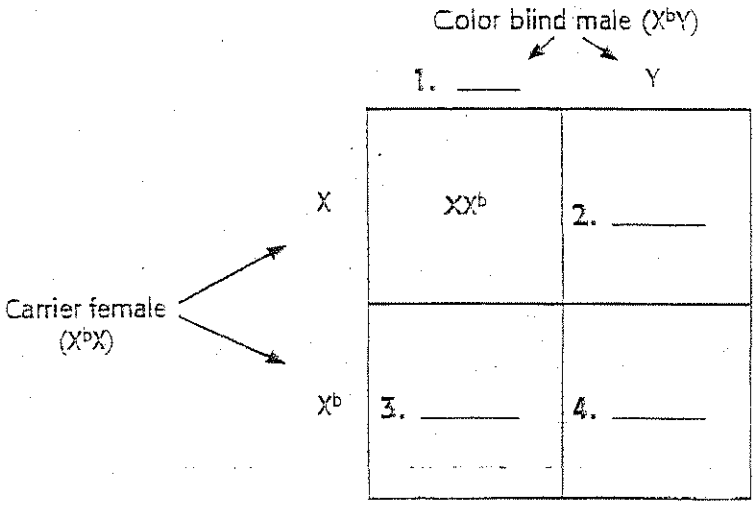
Trait	Possible Alleles
Normal male	XY
Colorblind male	X^bY
Carrier female	X^bX
Colorblind female	X^bX^b

A color-blind husband has children with his wife who carries the gene for color-blindness. What are the possible combinations of genes in their children?

Complete the missing parts of the Punnett square.

Step 1 Place one of the allele sets from one parent plant on the left side of the Punnett square and the other parent allele set across the top of the square.

Step 2 Match an allele from each parent into each of the sections of the Punnett square.



Step 3 Count the outcomes as a fraction and a percentage.

Allele Combinations	Number	Male or Female?	Color-blind?	Fraction	Percentage
XY	1 section out of 4	Male	No	5.	6.
X^bY	1 section out of 4	7.	8.	9.	10.
X^bX^b	1 section out of 4	11.	12.	13.	14.
XX^b	1 section out of 4	Female	15.	16.	17.

18. A male with colorblind vision (X^bY) marries a female who is a carrier of the gene for colorblindness (XX^b). What are the possible combinations of genes for their children?

_____

Extra Sex-linked Problems Name_____

XX = female, normal

XY= male, normal

X^HX= female, carrier

X^HY= male, hemophiliac

X^HX^H = female,hemophiliac

1. A woman who is a carrier marries a normal man. Show the cross. What is the probability that their children will have hemophilia? What sex will a child in the family with hemophilia be?

2. A woman who has hemophilia marries a normal man. How many of their children will have hemophilia, and what is their sex?

3. In cats, the gene for calico (multicolored) cats is codominant. Females that receive a B and an R gene have black and orange splotches on white coats. Males can only be black or orange, but never calico.

Here's what a calico female's genotype would look like. $X^B X^R$

Show the cross of a female calico cat with a black male? _____x_____

What percentage of the kittens will be black and male? _____
What percentage of the kittens will be calico and male? _____
What percentage of the kittens will be calico and female? _____

4. Show the cross of a female black cat with a male orange cat.

What percentage of the kittens will be calico and female? _____
What color will all the male cats be? _____

Karyotype Interpretation

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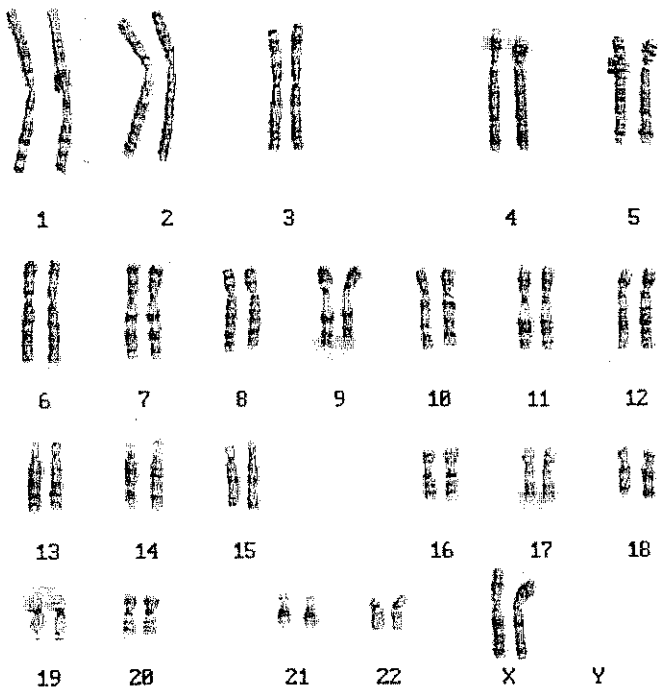


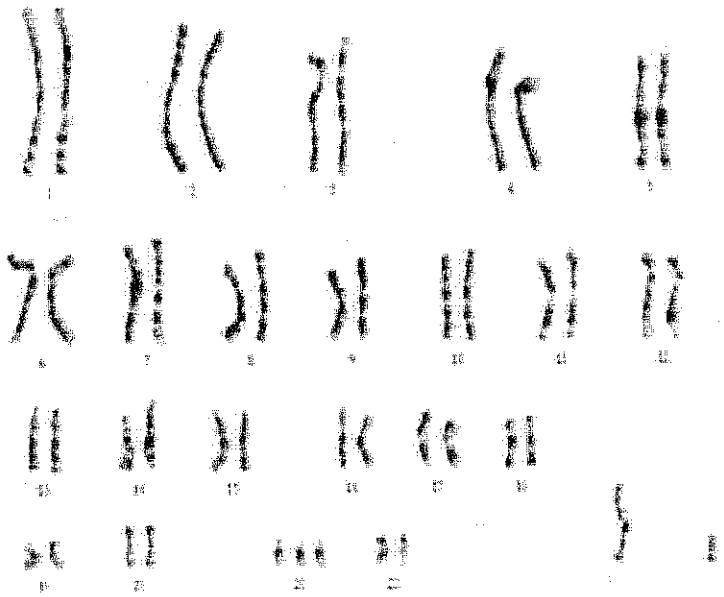
Patient A

Pattern of Inheritance:

Chromosomal Abnormality:

Interpretation and Notation:

lient B:



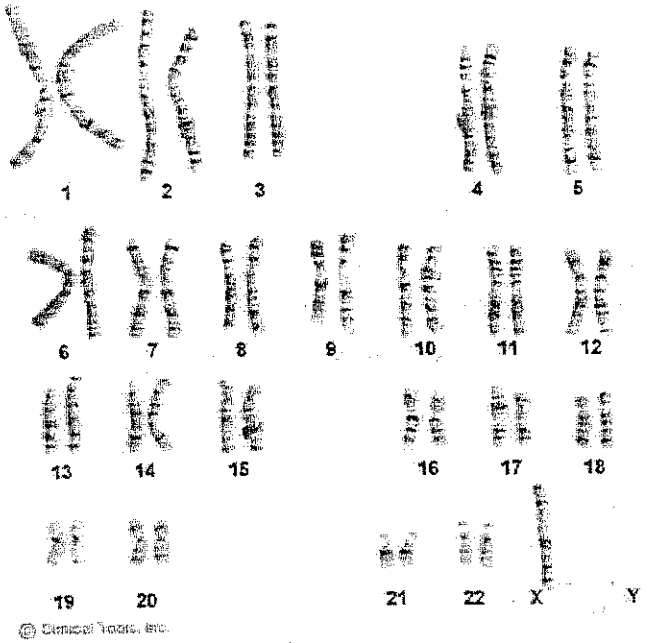
Patient B

Pattern of Inheritance:

Chromosomal Abnormality:

Interpretation and Notation:

Patient C: Turner's Syndrome (1 in 2000)



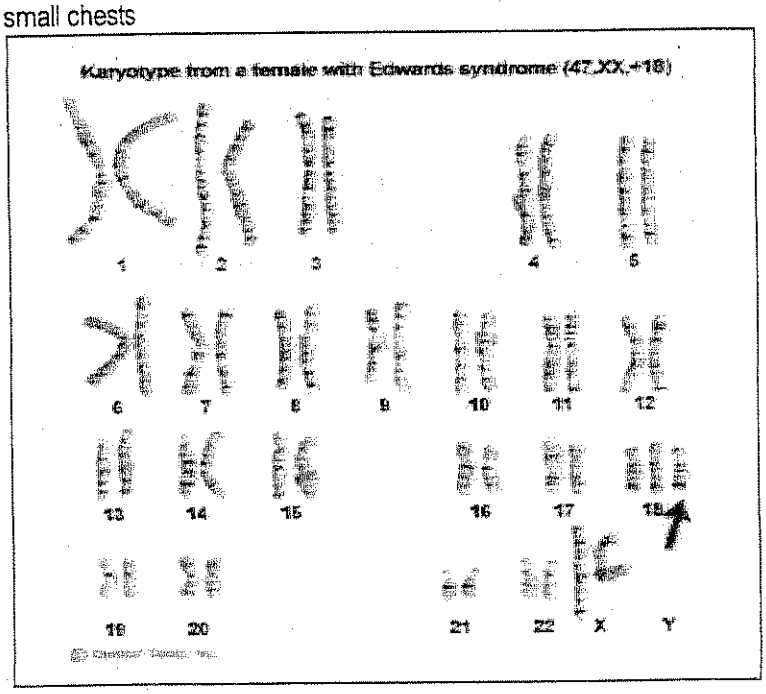
Patient C

Pattern of Inheritance:

Chromosomal Abnormality:

Interpretation and Notation:

Patient D: Edward's Syndrome – only 1 and 8000 live births (fetus usually does not survive) – affects facial features, clenched fists, small chests



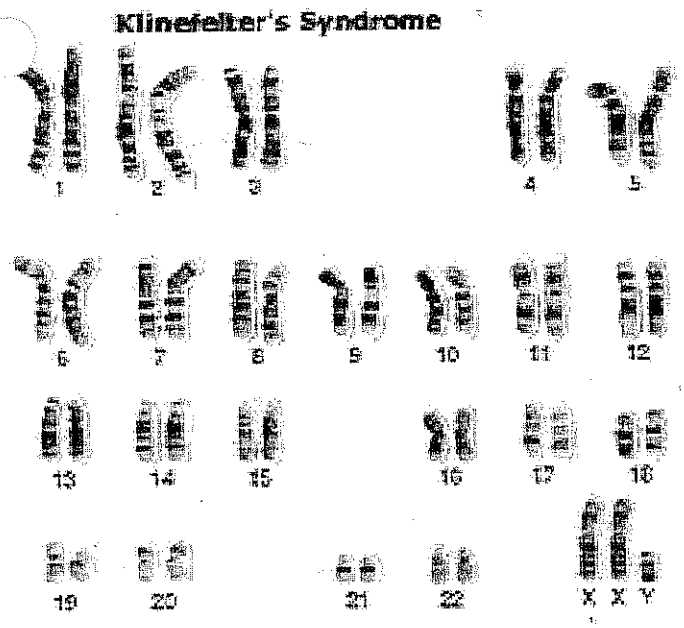
Patient D

Pattern of Inheritance:

Chromosomal Abnormality:

Interpretation and Notation:

Patient E: Klinefelter's Syndrome (1 in 500)



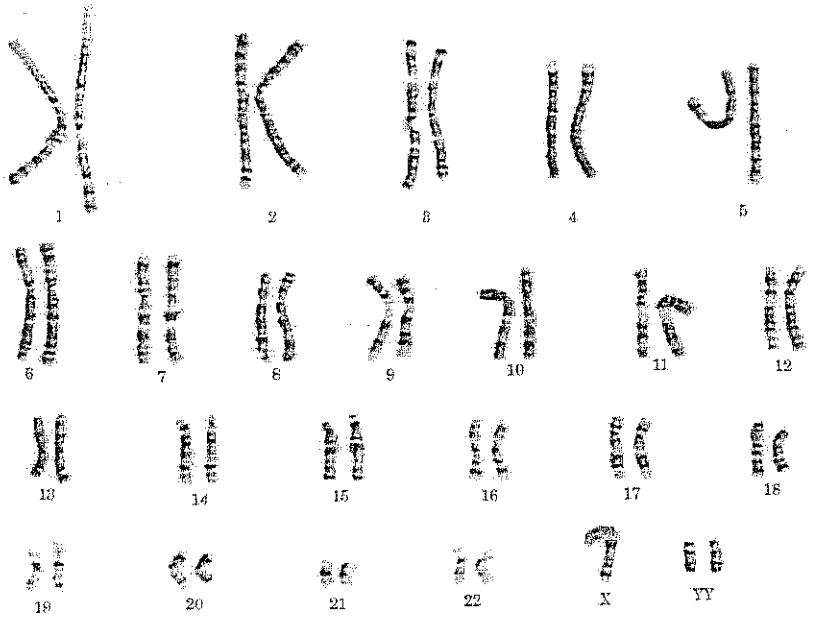
Patient E

Pattern of Inheritance:

Chromosomal Abnormality:

Interpretation and Notation:

ient F:



Patient F

Pattern of Inheritance:

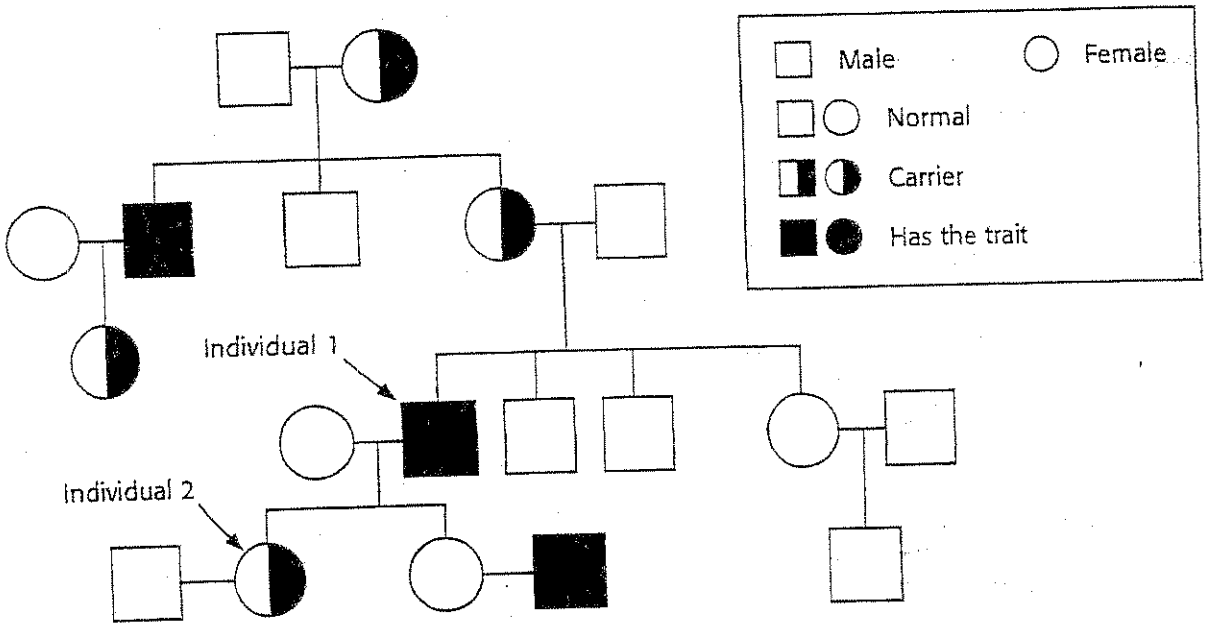
Chromosomal Abnormality:

Interpretation and Notation:

Name _____ Date _____

Pedigrees

The pedigree chart below traces the inheritance of color blindness in a family. A pedigree is a chart that tracks which family members have a particular trait. A carrier is an individual that has the gene for the trait, but does not show that trait.



1. How many males are shown in this chart? _____
2. How many females? _____
3. How many individuals are color blind? _____

   What is the sex of these individuals? _____
4. How many individuals are carriers? _____

   What is the sex of the carriers? _____
5. Are there any male carriers? _____ Any females with the trait? _____
6. Individual 1 has the trait. What do you notice about this person's parents? _____

   _____
7. Can a male inherit the trait if his mother is not a carrier? _____
8. How can a female child be a carrier? _____

   _____
9. Individual 2 marries a male who does not have the trait. Could this couple have a child that has the trait? _____