Heredity

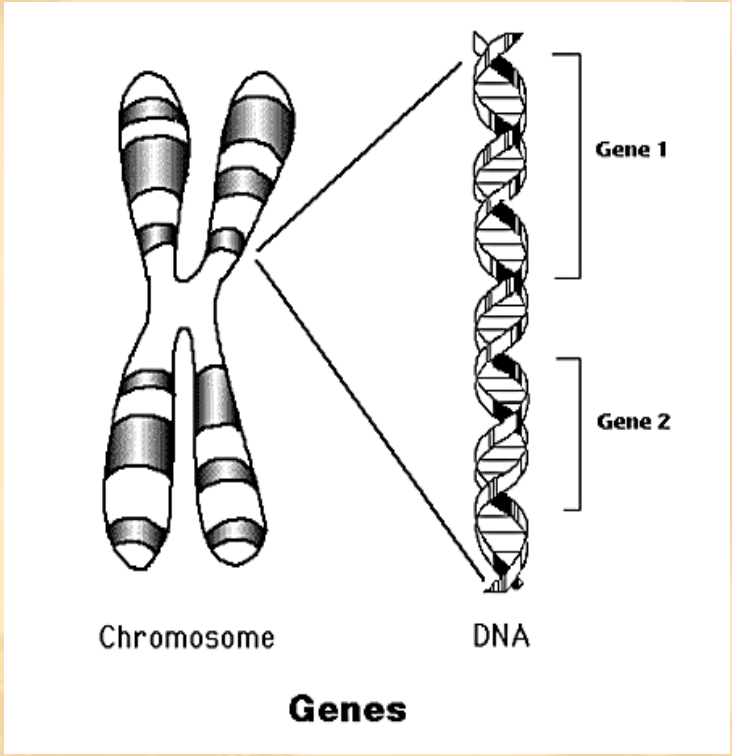
Genetics*

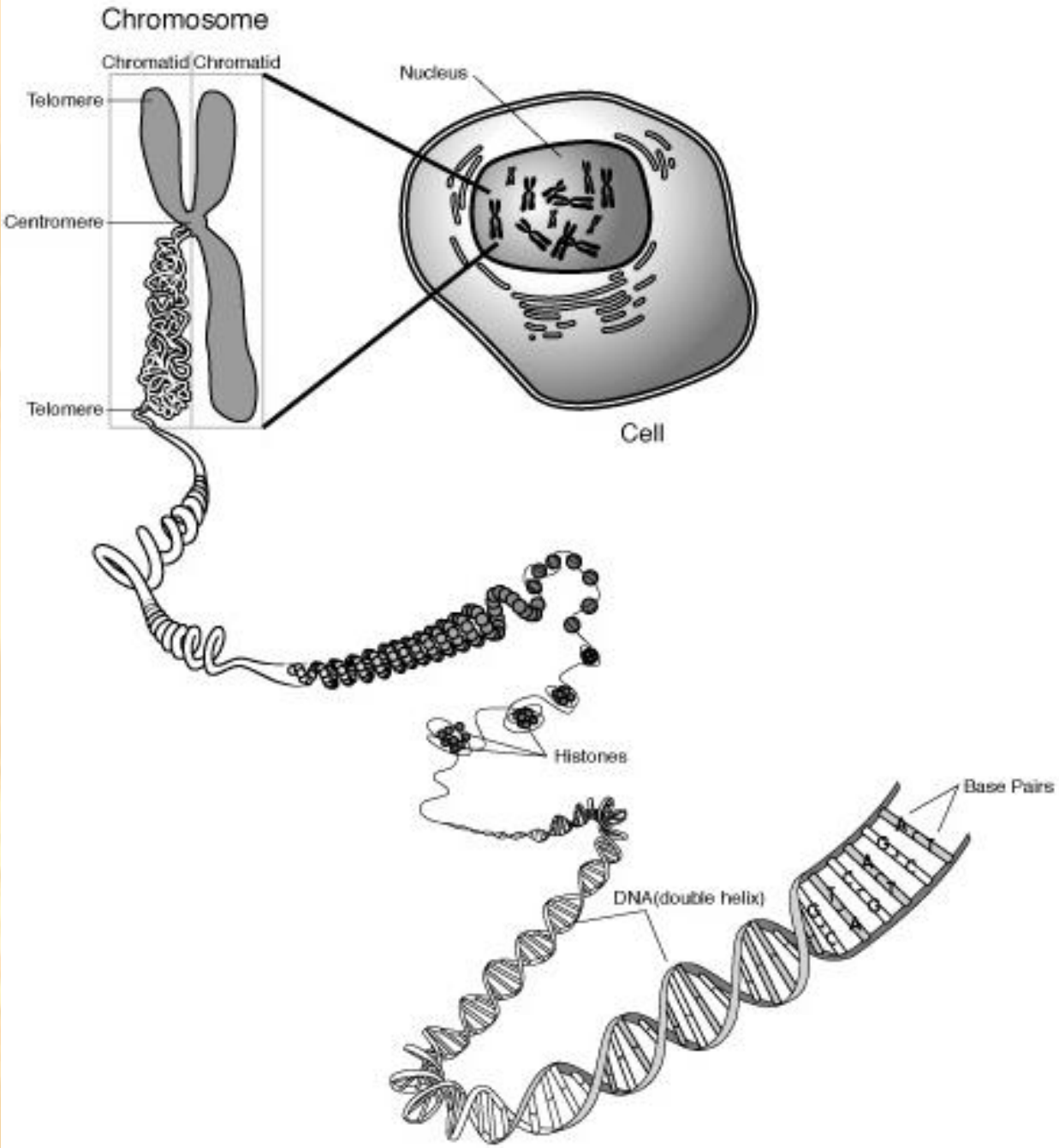
- the study of Genes and how they work
- This chapter is a lot about knowing your vocabulary

Genes

- **Genes are found on DNA and DNA make up chromosomes**
  - **Genes are the information about how a protein is to be made**
  - **During meiosis pairs of chromosomes split so each sex cell has one form of a gene for each trait.**
  - **Trait is the expressed gene**
  - **The different forms a gene may have for a trait are called alleles.**

*Where are genes located?**




Chromosome
Chromatid
Chromatid
Telomere
Centromere
Telomere
Nucleus
Cell
Histones
Base Pairs
DNA(double helix)

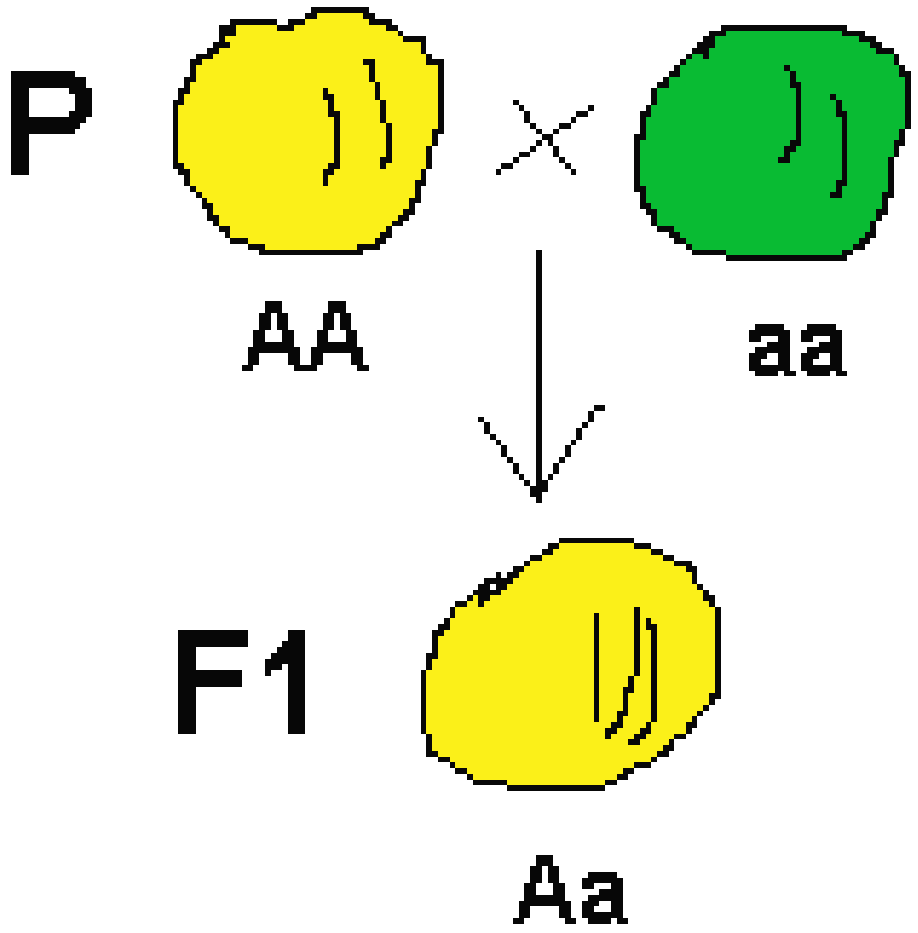
Gregor Mendel*

- Called the father of Genetics*
- He was a monk in a monastery
- Studied peas an inherited traits in the 1860's

Gregor Mendel

Gregor Mendel's Work

- **Gregor found it curious how traits were passed from one generation to the next.**
- **Mr. Mendel used pea plants for his experiments.**
- **Gregor cross pollinated a *purebred* tall pea plant with a *purebred* short Pea plant This is called the parental cross**
  - **The results of this cross were all tall peas.**
  - **These are called the *first generation* cross or the f1 generation***
- What is the f_1 generation?*



The F_1 generation.

- Gregor crossed to tall pea plants from this first cross
  - The results were 3 tall to one short
  - These are called the second generation f_2
- Gregor then crossed a purebred short with a crossed tall
  - Gregor found that ½ of the offspring were Tall and ½ of the offspring were short

*What is the f_2 generation?**

Mendel used math to figure out what was going on.

- **The use of probability to predict the possible results of a cross**
  - **Probability is the mathematical likelihood that something will happen**
  - **Examples:**
    - **1/6 chance that you will roll a six when you roll a dice**
    - **When you flip a coin there is a 50% chance that you will roll heads and a 50% chance that you will roll tails**
  - **probability can be applied to genetics**

Probability

- The likelihood of a particular event occurring. Chance
- Can be expressed as a fraction or a percent.
- Example: coin flip.
- Heredity is a chance for each trait

(explain)

Terminology

- Homozygous*
- Heterozygous*
- Genotype*
- Phenotype*

*Know what each of these terms mean.**

- **Mendel said that the results were the result of dominant and recessive traits**
  - **Dominant traits mask over the recessive***
  - **Letters are used to represent the different alleles**
    - **Dominant traits are represented by capital letters and recessive are represented by lower case letter**
    - **Most cells have two alleles for every trait**
  - **If both alleles that an organism possess for a certain trait are the same they are homozygous TT, tt**
  - **If an organism has alleles that are different they are heterozygous Tt**

Punnett Square*

- We will us a punnett square to help us figure probabilities
- Example: If a heterozygous Tall, Tt, plant was crossed with another heterozygous Tt plant

Tt x Tt

*Be able to use the punnett square**

	T	t
T	TT	Tt
t	Tt	tt

Genotype & Phenotype

- **Genotype is the genes that are present in the organism. Example TT, Tt or tt***
- **Phenotype is how something looks on the outside, like Tall or short***

What is phenotype and what is genotype?

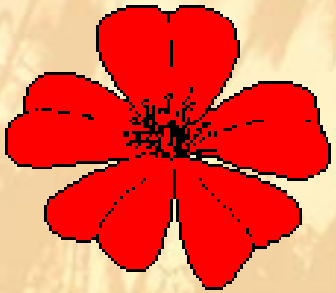
What Works for Peas Also Works for Humans

An albino woman

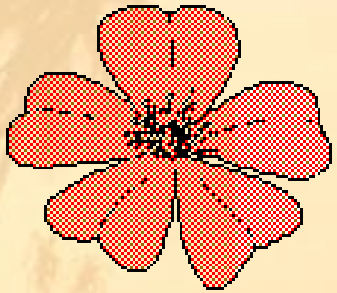
In the cross *Aa* x *Aa*, where *A* is a dominant gene for (standard) pigmentation and *a* is a recessive allele for no pigmentation (albinism), ¾ of offspring will be normal and ¼ will be albino.

Incomplete dominance

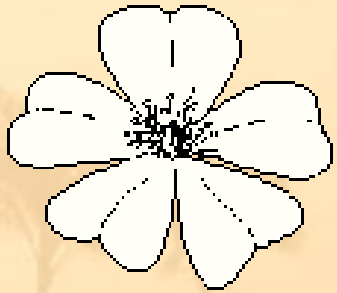
- genes are neither dominant or recessive and they express themselves equally
- Example would be when red and white four-o-clocks were crossed they produced pink four-o-clocks
  - RR x R'R'
  - Equal expression of the genes



homozygous dominant
(AA)



heterozygous
(Aa)



homozygous recessive
(aa)

	R'	R'
R	RR'	RR'
R	RR'	RR'

Blood type & incomplete dominance

- **Type A and Type B blood are dominant to Type O blood**

  If AO x BO

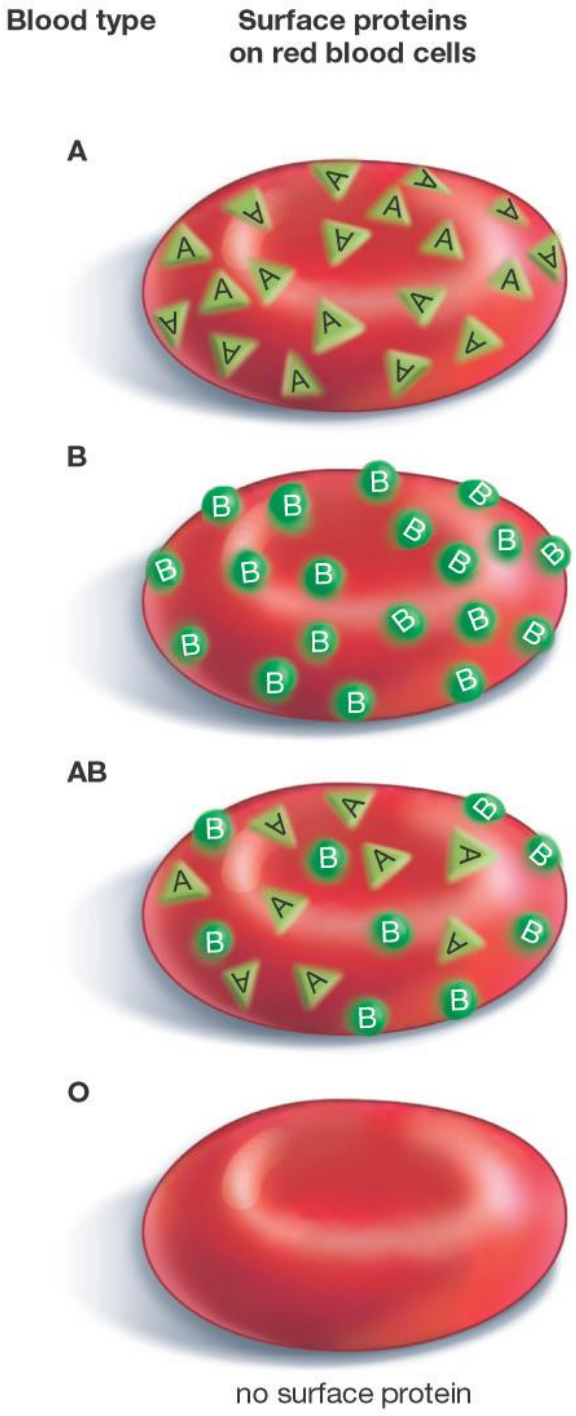
	B	O
A	AB	AO
O	BO	OO

- **The resulting phenotypes would be one AB to one AO to one BO to one OO**

Multiple Alleles

Many genes are present in 3 or more versions (alleles) – this is known as multiple alleles.

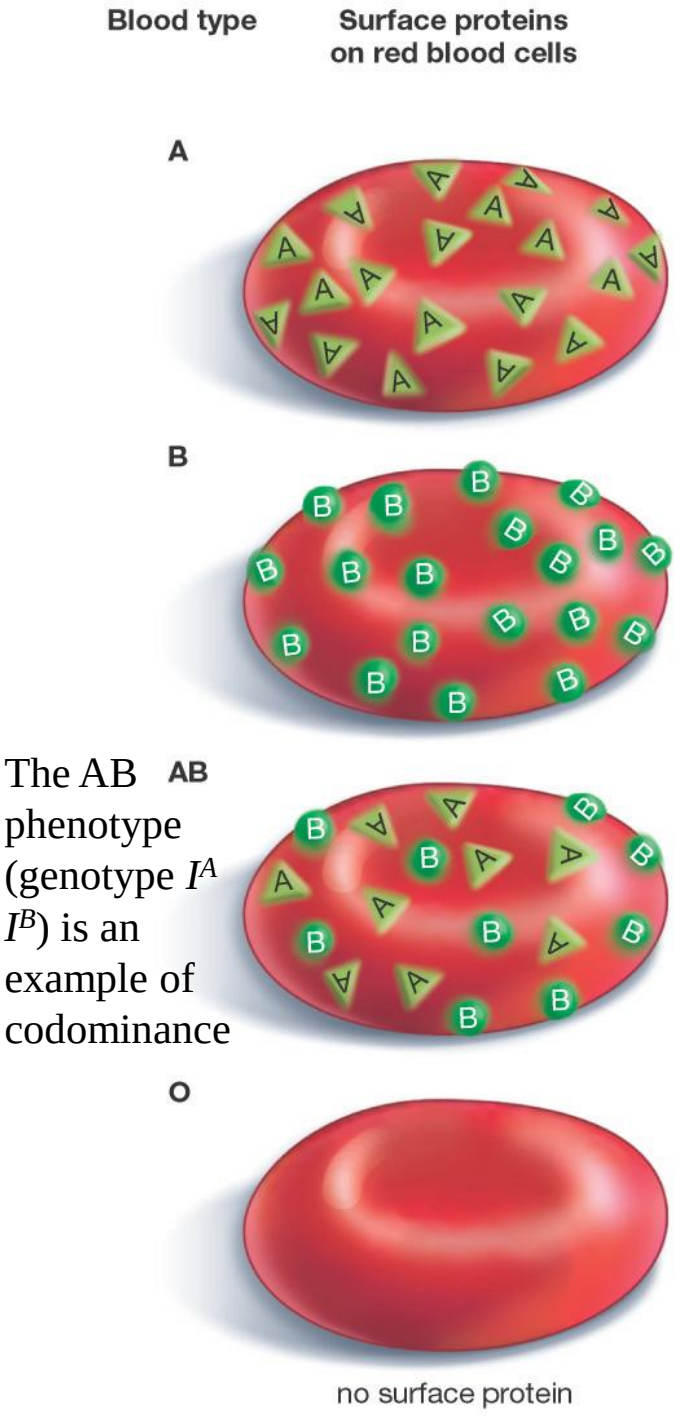
The human ABO blood group is determined by three alleles (I^A, I^B, and i) of a single gene.



Codominance

The human ABO blood group illustrates another genetic phenomenon – codominance.

Codominance occurs when the phenotype associated with each allele is expressed in the heterozygote.



The AB phenotype (genotype $I^A I^B$) is an example of codominance

Question

- Little Bobby's blood type is A
- His mom has type O
- What are two possible genotypes for his father?
- Hint:
  - Punnett Squares
  - We get half our alleles from one parent

Polygenic inheritance

- **occurs when a group of gene pairs act together to produce a single trait**
  - **Example; height, body build, shape of eyes, lips, ears, hair color, finger prints**

Genetic Disorders

- **Homozygous Recessive genetic disorders**
  - **Sickle Cell Anemia**
  - **Cystic Fibrosis**

  Name two homozygous recessive disorders.*

Cystic Fibrosis

- Most common U.S. lethal genetic disorder
- Recessive
  - 1 in 25 Caucasians carries it
  - A carrier if single allele
  - Afflicted if two copies of allele
- Overly thick mucous

Dominant Disorders

- Single or both alleles will give disorder
- Some are lethal—how can these exist?
  - Disorders occur late in life (after reproduction)
  - Huntington's disease
  - Some Alzheimers

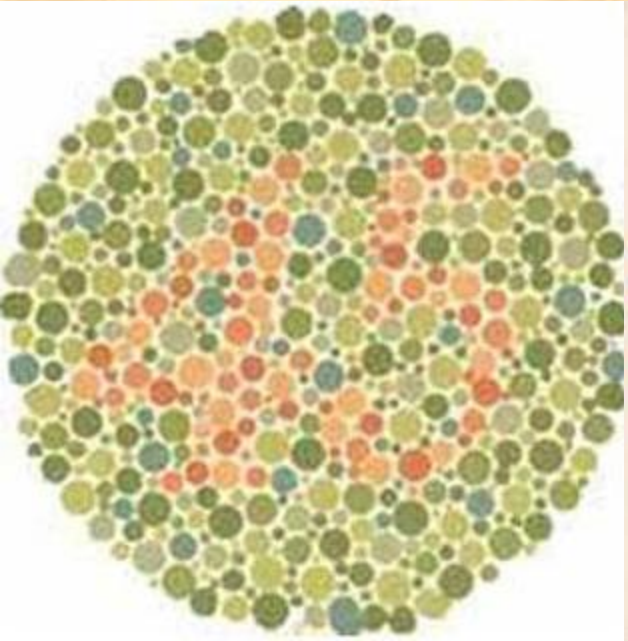
How sex determination works

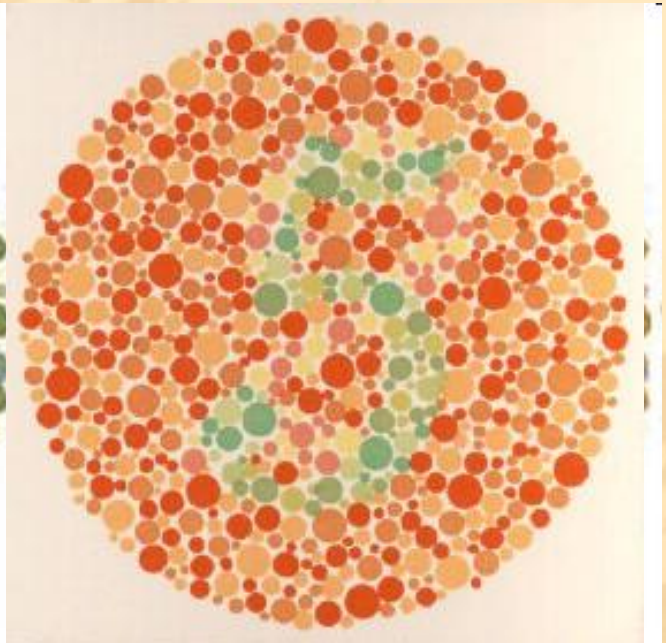
- You receive a sex chromosome from your father and a sex chromosome from your mother.
- The mother gives an X sex chromosome and the Father gives an X or a Y sex chromosome

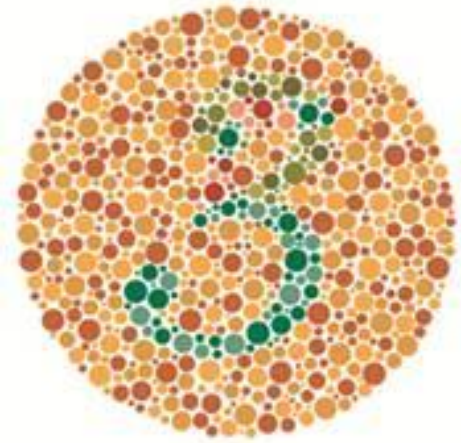
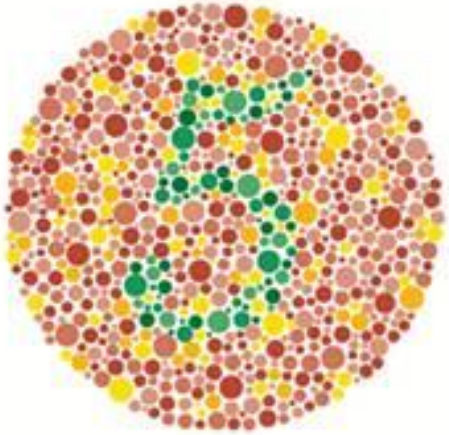
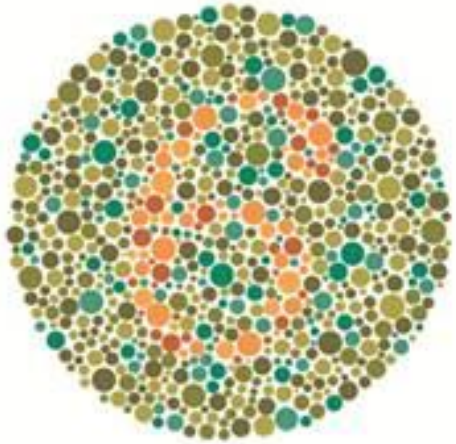
- If you received an X chromosome from your dad you're a girl, if you received a Y chromosome from your dad you're a boy.

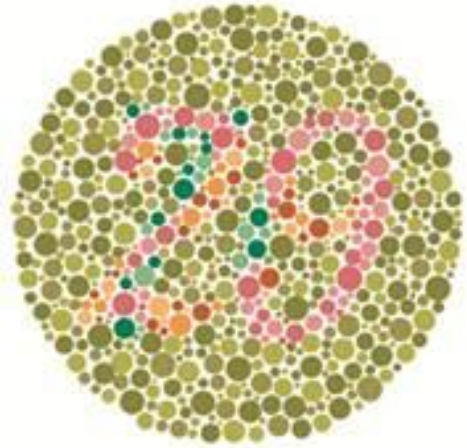
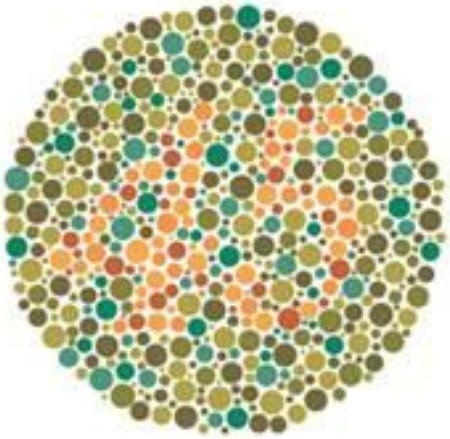
Sex linked disorders

- These are disorders that are linked to the X sex chromosome
- Males get the sex linked disorders most often

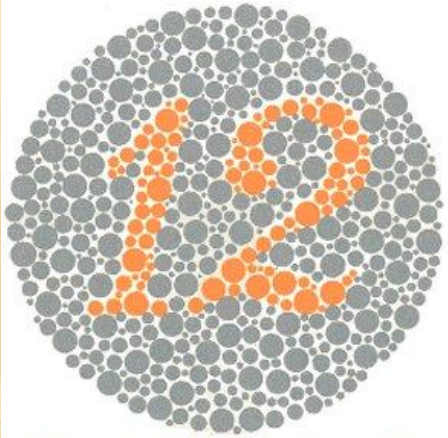




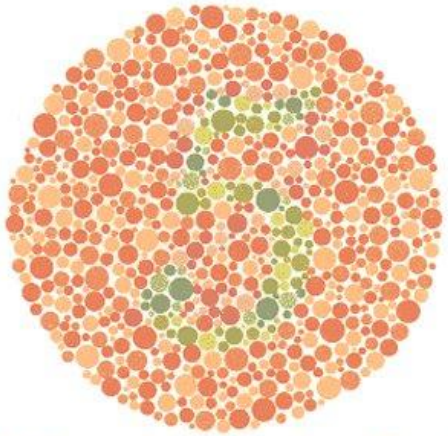




12



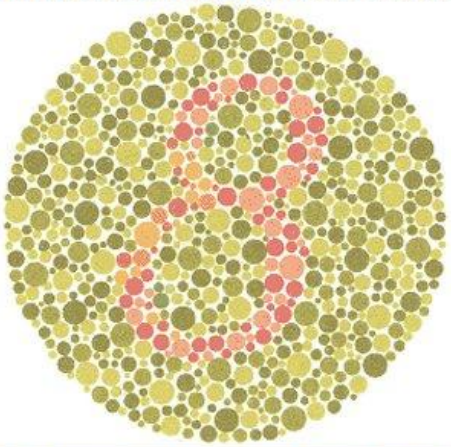
Ishihara Color Blindness Test Plate 1



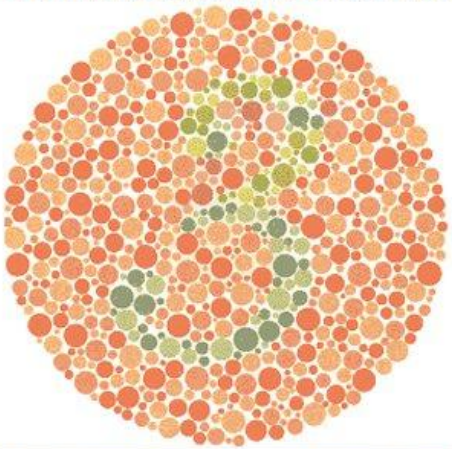
Ishihara Color Blindness Test Plate 4



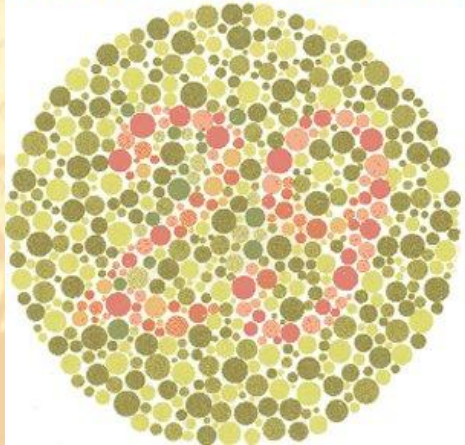
Ishihara Color Blindness Test Plate 2



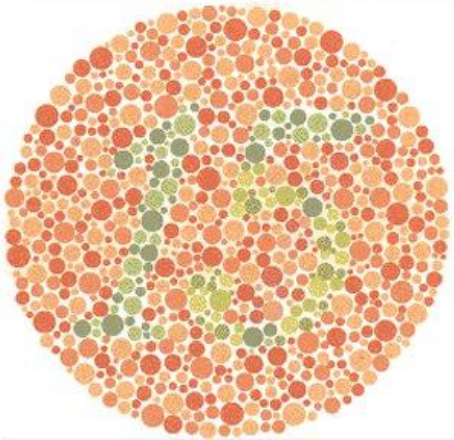
Ishihara Color Blindness Test Plate 5



Ishihara Color Blindness Test Plate 3



Ishihara Color Blindness Test Plate 6



Examples of sex linked disorders

- **These genetic disorders are caused by a recessive allele on the X chromosome**
  - **Color blindness**
  - **Hemophilia**

Name two sex linked disorders.*

Example of a sex linked characteristic

- Color blindness if a woman who caries color blindness marries a normal man, what is the chance that their boy will be colorblind? X_NX_n x X_NY
- The results would be ½ of the boys would be color blind

	X_N	Y
X_N	X_NX_N	X_NY
X_n	X_NX_n	X_nY

Pedigree

- **is a tool used for tracing the occurrence of a trait in a family**
  - Page 140 in your book gives examples of pedigree

*Be able to read a pedigree.**