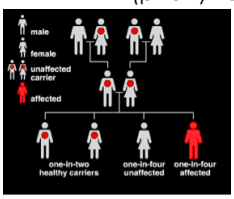
Recessive, Dominant, and Sex-Linked Trait

Recessive, Dominant, & Sex-Linked Disorders

- some genetic traits depend on ***dominant*** and ***recessive*** alleles
- some gene expression depends on the ***chromosome*** it is on
  - ***autosome*** or ***sex*** chromosome

Disorders by Recessive Alleles:

- people with a disorder (***affected***) must have both recessive alleles (tt, rr, bb)
- parents that are homozygous dominant are considered ***normal*** (TT, RR, BB)
- parents that are heterozygous for a particular disorder are considered ***carriers*** and can pass the trait onto their offspring (Tt, Rr, Bb)
- Diseases/Traits: Albinism, Cystic Fibrosis, PKU (phenylketonuria), Tay-Sachs Disease

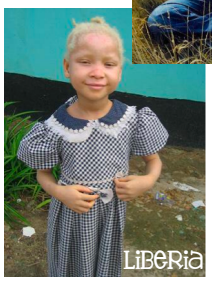


AA NORMAL	Aa CARRIER
Aa CARRIER	aa AFFECTED

Albinism

- 1 in 17,000 births
- no pigmentation in hair, skin, eyes
- eye sensitivity and vision problems
- UV radiation (sun) can easily damage skin


HONDURAS


LIBERIA

Genetics Practice #1

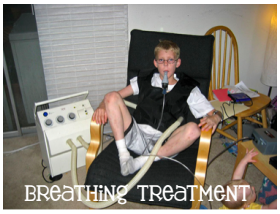
Craig and Nina are married and have four children. Both Craig and Nina have brown eyes and hair and light-medium skin. However, 2 of their 4 children have albinism. (Use the letters AA, Aa, or aa.)

1. What is Craig's genotype?
2. What is Nina's genotype?
3. What is the probability that their next child will also have albinism?

Cystic Fibrosis

- 1 in approximately 2000 births
- defective CFTR gene...protein pump in cell membrane not made properly or at all
- mucus clogs lung, liver, and pancreas
- affects young children to young adults
- high mortality rate
- life expectancy currently into the 30s (if given the best care/treatment)
- NO cure yet

CLICK FOR CF AWARENESS VIDEO


BREATHING TREATMENT

Genetics Practice #2

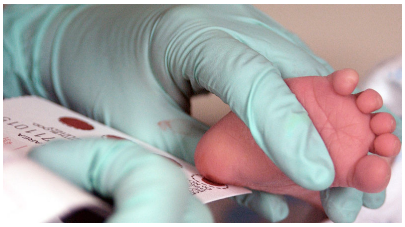
A couple who are both carriers of the gene for cystic fibrosis have two children who have cystic fibrosis. (Use the letters FF, Ff, or ff.)

1. What would be the genotypes of the parents?
2. What would be the genotype for their children with CF?
3. What is the probability that their next child will have cystic fibrosis?

Recessive, Dominant, and Sex-Linked Trait

PKU (PHENYLKETONURIA)

- 1 in 10,000 births
- cannot digest phenylalanine and it builds up causing severe complications including brain damage and even death
- PKU diet does not allow consumption of meat, fish, poultry, milk, eggs, cheese, ice cream, legumes, nuts, or many products containing regular flour
- NO cure yet



TAY-SACHS

- most common in people of Jewish ancestry
- metabolic disorder
- fat builds up and destroys the brain
- life expectancy is about 3 years

CLICK FOR AWARENESS VIDEO

DISORDERS CAUSED BY DOMINANT ALLELES

- people with a dominant allele disorder need to have ***one*** allele to inherit the disease
- homozygous dominant and heterozygous individuals would be affected
- if a parent has a dominant allele, there is a 50/50 chance of passing it on to their offspring
- Diseases/Traits: achondroplasia and Huntington's disease

~~AA~~ AFFECTED	Aa AFFECTED
Aa AFFECTED	aa NORMAL

ACHONDROPLASIA

- most common form of dwarfism
- Aa genotype = achondroplasia

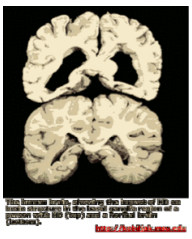
GENETICS PRACTICE #3

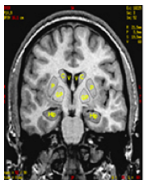
Matt and Amy Roloff have four children. Although Matt and Amy are both little people, they do not have the same type of dwarfism. Amy has achondroplasia, which is a dominant allele disorder. There children are: twins Zach and Jeremy, Molly, and Jake. Three of the four children are average height. Zach has achondroplasia like his mother.

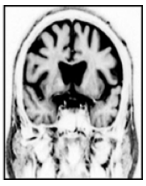
Show the results of the Roloff family in a Punnett square. Matt (aa) is normal or does NOT have achondroplasia. Amy has achondroplasia (Aa).

HUNTINGTON'S DISEASE

- 1 in 10,000
- gradual deterioration of brain tissue during middle age
- shortened life span







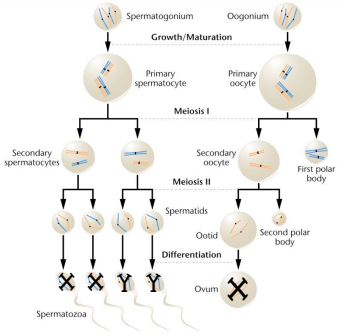
Recessive, Dominant, and Sex-Linked Trait

Sex-Linked Traits

- some traits and disorders are located on the sex chromosomes (23rd pair)
- genes located on the sex chromosomes (X, Y) are said to be "**sex-linked**"
- ***the probability of inheriting a particular trait depends on if your are a boy or girl***
- must use **XX** and **XY** in your Punnett squares
- Diseases/Traits: colorblindness, hemophilia, Duchene's Muscular Dystrophy, ALD (adrenoleukodystrophy)

Chromosome Review

- XX = female and XY = male
- all eggs contain one X
- sperm contain an X or a Y

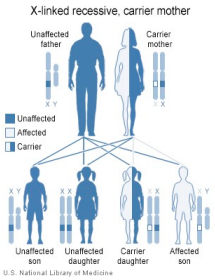


Sex-Linked Punnett Square

	X^N	X^n
X^n	X^NX^n	X^nX^n
Y	X^NY	X^nY

More Males than Females

- Why are X-linked traits more common in males than females?
- males have just one X chromosome
- thus, all X-linked alleles are expressed in males, even if they are recessive
- females need two alleles for it to be expressed

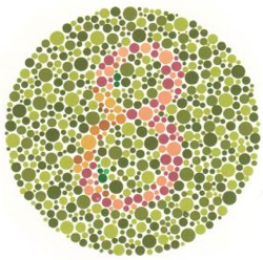


	Normal	Carrier	colorblind
Male	X^NY	----	X^nY
Female	X^NX^N	X^NX^n	X^nX^n

Colorblindness

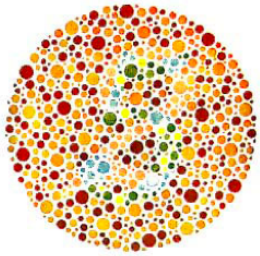
- 1 in 10 males and 1 in 100 females
- cannot detect red from green (most common)
- Punnett Square Example:
  Mom is a carrier and Dad is Normal

Colorblind Test #1

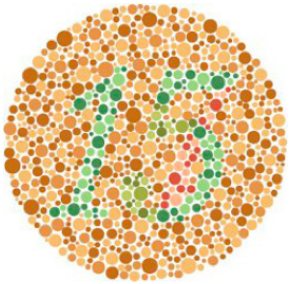


Recessive, Dominant, and Sex-Linked Trait

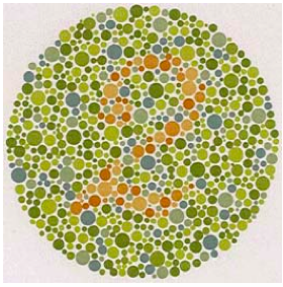
COLORBLiND TeST #2



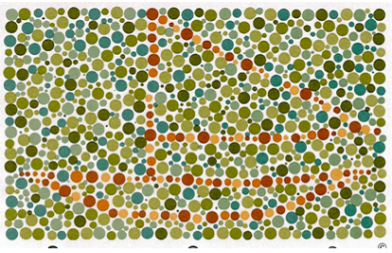
COLORBLiND TeST #3



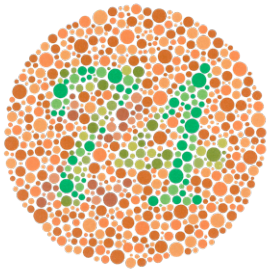
COLORBLiND TeST #4



COLORBLiND TeST #5



COLORBLiND TeST #6



GeNeTiCS PRaCTiCe #4

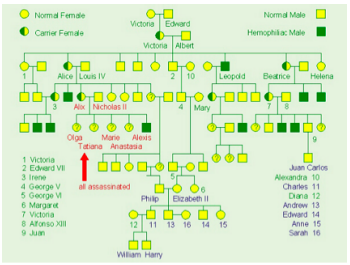
Jeff and Emily are married and expecting their first child. Jeff has normal vision and so does Emily, but she is a carrier for colorblindness. (MUST USE XX and XY.)

1. What is the probability that their child will be colorblind?
2. They find out that they will be having twins (one boy and one girl).
3. What is the probability that their son will be colorblind?
4. What is the probability their daughter will be colorblind? Carrier? Normal?

Recessive, Dominant, and Sex-Linked Trait

Hemophilia

- 1 in 10,000 males
- defective gene for clotting factor XIII
- "Royal" disease



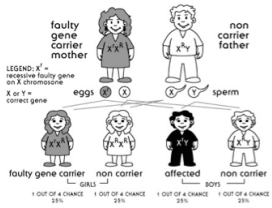
Genetics Practice #5

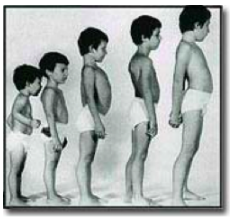
Sofia, whose blood clots normally, has a hemophilic father. Her husband's (Tommy) blood clots normally. Their first child was a girl and their second child was a boy.

1. What is Sofia's genotype and phenotype?
2. What is Tommy's genotype and phenotype?
3. What are the possible genotypes for their daughter?
4. What are the possible genotypes for their son?
5. What are the chances their 3rd child will be a girl that is also a carrier for hemophilia?

Duchene's Muscular Dystrophy

- 1 in 3000 males
- progressive weakening and loss of skeletal muscle
- rarely live past early adulthood





Genetics Practice #6

Elizabeth and Sam have an 18 month old son named Scotty. He was late to walk, stumbles easily, and has difficulty getting up and moving around. After many tests, it was determined that Scotty inherited Duchene's Muscular Dystrophy (DMD), which is an X-linked trait. Both parents are unaffected.

1. What is Elizabeth's genotype and phenotype?
2. What is Sam's genotype and phenotype?
3. What is the genotype for their son, Scotty?
4. What is the probability that they will have a girl with DMD?
5. Elizabeth is expecting another child. What is the probability she will have another child with DMD?
6. She finds out that the child will be a girl. What is the probability that she will be normal and NOT carry the gene for DMD?

ALD (adrenoleukodystrophy)

- 1 in 20,000
- fat builds up in the brain and disrupts normal activity
- NO cure yet