Concept Development 1B - Part 3:
PREDICTING THE INHERITANCE OF TRAITS CONTROLLED BY ALLELES ON THE SEX CHROMOSOMES

1. A male and female marry and intend to have children. For the trait of sex, what are the genotypic and phenotypic ratios of the offspring they intend to produce. You must use a punnett square to support your answer!!!!

	X	X
X	XX	XX
Y	XY	XY

GENOTYPIC RATIOS 1 XX 1 XY
PHENOTYPIC RATIOS 1 female 1 male
% CHANCE OF 3 GIRLS IN A ROW? 1/8

12.5%

In addition to carrying genes which help determine the sex of a child, the X and Y chromosomes both carry additional genes which are necessary for traits having nothing to do with gender. In humans, the X chromosome is much larger and therefore carries more genes than the Y chromosome. Therefore, many more traits, and consequently diseases, are influenced by genes on the X chromosome. See the example problem below for a recessive allele carried on the X chromosome which influences muscle function.

Example: Duchenne Muscular Dystrophy is a disease in which those afflicted experience progressive loss of muscle function. The disease is caused by a mutated protein called Dystrophin. The gene which codes for Dystrophin protein is located on the X chromosome. When the dystrophin gene is mutated, individuals acquire muscular dystrophy.

Muscular Dystrophy is an X-linked Recessive disease.

A male with muscular dystrophy marries and has children with a female who has no history of muscular dystrophy in her family. What is the probability that these two parents will have either of male or female child with muscular dystrophy?

*-X^dY (Father's genotype…….notice that the muscular dystrophy allele is **only** carried on the X chromosome.)*

*-X^DX^D (Mother's genotype……notice that **both** of her X chromosomes carry the healthy allele for muscle function.)*

Possible genotypes and corresponding phenotypes for males are:

-X^DY (healthy male)

-X^dY (muscular dystrophy male)

Possible genotypes and corresponding phenotypes for females are:

-X^DX^D (healthy female)

-X^DX^d (healthy female who carries the disease allele)

-X^dX^d (muscular dystrophy female)

	X^D	X^D
X^d	X^DX^d	X^DX^d
Y	X^DY	X^DY

Mother's Gametes

Father Gametes

Genotypic Ratio: 1 X^DX^d : 1 X^DY

Phenotypic Ratio:
1 healthy female (who carries the disease allele) : 1 healthy male

2. The recessive allele for congenital deafness is on the X chromosome. A woman who is normal but carries the allele for deafness intends to have children with a normal male. What is the percent chance that these parents will have a child with deafness? You must use a punnett square to defend your answer!!

	X^D	X^d
X^D	X^DX^D	X^DX^d
Y	X^DY	X^dY

X^D - normal

X^d - deaf

GENOTYPIC RATIOS

1 X^DX^D 1 X^DX^d 1 X^DY 1 X^dY

PHENOTYPIC RATIOS

2 normal females
1 normal male
1 deaf male

% CHANCE THAT THIS COUPLE WILL HAVE A DEAF CHILD? 25%

% CHANCE THAT THIS COUPLE WILL HAVE 2 DEAF BOYS? $\frac{1}{16}$ OR 6.25%

3. The alleles which control the successful clotting of blood and the disease of hemophilia are located on the X chromosome. Hemophilia is caused by a recessive allele. Consider the phenotypes of the offspring listed below. What are the genotypes of the parents who have produced these offspring? You must use a punnett square to defend your answer!!

-The couple has 3 boys, all of which have hemophilia
-The couple has two girls, neither have hemophilia

X^H - normal
X^h - hemophilia

	X^h	X^h
X^H	$X^H X^h$	$X^H X^h$
Y	$X^h Y$	$X^h Y$

PARENTAL GENOTYPES
$X^h X^h$ and $X^H Y$

4. Two demons are having a child. The alleles which control whether a demon has bat wings (dominant) are located on the X chromosome. The alleles which control whether a demon will have hoofed feet (dominant) are on an autosomal chromosome. Use this information for the following scenario.

A female demon has parents with the following characteristics:
-angelic father…….feather wings and tiny feet.
-mothers side of the family all have bat wings and hoofed feet

A male demon has parents and grandparents who all have bat wings, but his mothers side of the family all have tiny feet his fathers side of the family all have hoofed feet.

What is the chance that these parents will have an angelic child (feather wings and tiny feet)? You must provide a punnett square as evidence for your answer!!

PARENT GENTOTYPES:
$X^B X^b Hh$ (Female demon) × $X^B Y Hh$ (Male Demon)

	$X^{B}H$	$X^{B}h$	$X^{b}H$	$X^{b}h$
$X^{B}H$				
$X^{B}h$				
YH				
Yh				$X^{b}YhH$

female

CHANCE OF HAVING AN ANGELIC CHILD?	WHAT SEX WOULD THEIR ANGELIC CHILD BE?
$\frac{1}{16}$ 6.25%	male

5. Hunter Syndrome is caused by a recessive allele located on the X chromosome. Use this information in order to **complete the pedigree** below. Be sure to label each individual with the **correct Pedigree nomenclature**. Additionally, label each individual with their known **genotype or possible genotype with percent chance.**

**Individuals I-2, II-4,and III-7 all do not carry the disease allele. **

Determine the known or possible genotypes with percent chance for all individuals with a ?

H = HEALTHY and NOT a carrier

See this link for information regarding Hunter's syndrome: http://en.wikipedia.org/wiki/Hunter%27s_Syndrome