Genetics Coin Tossing Lab

Why do people, even closely related people, look slightly different from each other? The reason for these differences in physical characteristics (called phenotype) is the different combination of genes possessed by each individual.

To illustrate the tremendous variety possible when you begin to combine genes, you and a classmate will establish the genotypes (genetic makeup) for a potential offspring. Your baby will receive a random combination of genes that each of you, as genetic parents, will contribute. Each normal human being has 46 chromosomes (23 pairs - **diploid**) in each body cell. In forming the gametes (egg or sperm), one of each chromosome pair will be given, so these cells have only 23 single chromosomes (**haploid**). In this way, you contribute half of the genetic information (**genotype**) for the child; your partner will contribute the other half.

Because we don't know your real genotype, we'll assume that you and your partner are heterozygous (big letter and small letter, Ex: Aa) for every facial trait. Which one of the two available alleles you contribute to your baby is random, like flipping a coin. In this lab, there are 32 gene pairs and 26 traits, but in reality there are thousands of different gene pairs, and so there are millions of possible gene combinations!

Procedures

Record all your work on each parent's data sheet.

1. Determine your baby's gender. Remember, this is determined entirely by the father. The mother always contributes an X chromosome to the child since she is XX. The student representing dad should toss the coin and if:

   Heads = X chromosome, so the child is a GIRL

   Tails = Y chromosome, so the child is a BOY

2. Name the child (first and middle name; last name can be a combination of both last names).

3. Determine the child's facial characteristics by having each parent flip a coin.
   Heads = child will inherit the dominant allele (big letter).

   Tails = child will inherit the recessive allele (small letter).

   On the data sheet, circle the allele that the parent will pass on to the child and write the child's genotype. Always write the dominant letter before the recessive letter. Example: Aa, NOT aA

4. Using the information in this guide, look up and record the child's phenotype.

5. When the data sheet is completed, draw your child's portrait as he/she would look as a teenager. You must include the traits as determined by the coin tossing. Write your child's full name on the portrait.

Traits:

Face Shape	Rounded (AA or Aa) Square (aa)
Chin Size	Very prominent (BB or Bb) Less prominent (bb)
Chin Shape	Round (CC or Cc) Square (cc)
Cleft Chin	Present (DD or Dd) Absent (dd)
Skin Color: To determine this trait or any trait controlled by more than one gene (**polygenic trait**) you will need to flip the coin for each gene pair. Example: a. 1st coin determines if child is E or e b. 2nd coin determines if child is F or f c. 3rd coin determines if child is G or g So if you and your partner both toss heads for the first, heads and tails for the second and both tails for the 3rd trait, the genotype is EEFfgg and the skin color would be medium brown.	6 dominant alleles – black 5 dominant alleles – very dark brown 4 dominant alleles – dark brown 3 dominant alleles – medium brown 2 dominant alleles – light brown 1 dominant allele – light tan 0 dominant alleles – white
Hair Color: Follow the same instructions as for skin color but only toss the coins four times. Example: HHIiJjkk = light brown	8 dominant alleles – black 7 dominant alleles – very dark brown 6 dominant alleles – dark brown 5 dominant alleles – brown 4 dominant alleles – light brown 3 dominant alleles – brown mixed with blond 2 dominant alleles – blond 1 dominant allele – very light blond 0 dominant alleles – silvery white

Hair Type	Curly LL Wavy – Ll Straight – ll
Widows peak	Present (MM or Mm) Absent (mm)
Eye color: Toss the coins two times to determine eye color.	NNOO – black NNOo – dark brown NnOO – brown with green flecks NnOo – brown NNoo – violet Nnoo – gray-blue nnOO – green nnOo – dark blue nnoo – light blue
Eye distance	Close (PP) Average (Pp) Far apart (pp)
Eye size	Large (QQ) Medium (Qq) Small (qq)
Eye Shape	Almond (RR or Rr) Round (rr)
Eye Slant	Horizontal (SS or Ss) Upward slant (ss)
Eyelash length	Long (TT or Tt) Short (tt)
Eyebrow color	UU - Darker than Hair Uu - Same color as hair uu - Lighter than Hair
Eyebrow thickness	Bushy (VV or Vv) Fine (vv)
Eyebrow length	Not connected (WW or Ww) Connected (ww)
Mouth Size	Long (XX) Medium (Xx) Short (xx)
Lip thickness	Thick (YY or Yy) Thin (yy)
Dimples	Present (ZZ or Zz) Absent (zz)
Nose Size	Large (AA) Medium (Aa) Small (aa)
Nose shape	Rounded (BB or Bb) Pointed (bb)

Nostril Shape	Rounded (CC or Cc)	Pointed (cc)
Earlobe attachment	Free (DD or Dd)	Attached (dd)
Freckles on cheeks	Present (EE or Ee)	Absent (ee)
Freckles on forehead	Present (FF or Ff)	Absent (ff)

Name:_____Period:_____Date:_____

The Genetics of Parenthood Data Sheet

Child's gender _____ Child's name _____

Fill in data table as you determine each trait. Remember heads = dominant allele, tails = recessive allele.

Trait	Allele from mom (circle one letter from EACH pair)	Allele from dad (circle one letter from EACH pair)	Child's genotype	Child's phenotype
Face Shape	A a	A a		
Chin Size	B b	B b		
Chin Shape	C c	C c		
Cleft Chin	D d	D d		
Skin Color	E e F f G g	E e F f G g		
Hair Color	H h I i J j K k	H h I i J j K k		
Hair Type	L l	L l		
Widows peak	M m	M m		
Eye color	N n O o	N n O o		
Eye distance	P p	P p		
Eye size	Q q	Q q		
Eye Shape	R r	R r		
Eye Slant	S s	S s		
Eyelash length	T t	T t		
Eyebrow color	U u	U u		
Eyebrow thickness	V v	V v		
Eyebrow length	W w	W w		
Mouth Size	X x	X x		
Lip thickness	Y y	Y y		
Dimples	Z z	Z z		
Nose Size	A a	A a		

Nose shape	B b	B b		
Nostril Shape	C c	C c		
Earlobe attachment	D d	D d		
Freckles on cheeks	E e	E e		
Freckles on forehead	F f	F f		

Questions:

1. What percentage of a trait does each parent give to a child's genotype? _____

2. Read the 3 definitions below and examples
   - **Complete dominance** – The dominant allele is completely dominant over the recessive allele. There are only **TWO** phenotypes seen. Ex: RR or Rr – red, rr – white
   - **Incomplete dominance** – In a heterozygous, the traits blend together. **THREE** phenotypes are seen. Ex: RR=red, rr=white and Rr=pink
   - **Polygenic inheritance** - Many genes control the trait. With polygenic traits there are a **MANY** possible phenotypes.

   Choose 3 colors: red, blue, yellow. Look at the list below. Shade all the complete dominant traits red. Shade all incomplete dominant traits blue. Shade all of the polygenic traits yellow.

Face Shape	**Widows peak**	**Eyebrow color**	**Nose shape**
Chin Size	**Eye color**	**Eyebrow thickness**	**Nostril Shape**
Chin Shape	**Eye distance**	**Eyebrow length**	**Earlobe attachment**
Cleft Chin	**Eye size**	**Mouth Size**	**Freckles on cheeks**
Skin Color	**Eye Shape**	**Lip thickness**	**Freckles on forehead**
Hair Color	**Eye Slant**	**Dimples**	
Hair Type	**Eyelash length**	**Nose Size**	

Answer the following questions.

3. If a woman who is homozygous for almond-shaped eyes (AA) marries a man who is heterozygous for almond-shaped eyes (Aa), what are the genotypic and phenotypic ratios of their children?
   Punnett Square:

   Genotypic ratio: _____AA:_____Aa:_____aa

   Phenotypic ratio: _____almond eyes : _____ round eyes

4. How is it possible for you to show the trait when neither of your parents show it? Draw a Punnett square to support your answer.

5. What are the possible genotypes of the **<u>parents</u>** of a child who has wavy hair (Hh)? List **ALL** of the crosses possible. Hint: There are 4 possibilities.

_____ X _____, _____ X _____,

_____ X _____, _____ X _____