The Genetics of Parenthood

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 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 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 36 gene pairs and 30 traits, but in reality there are thousands of different gene pairs, and so there are millions of possible gene combinations!

Procedure:

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

1. First, determine your baby's gender. Remember, this is determined entirely by the father. The mother always contributes an X chromosome to the child.
    - ✓ Heads = X chromosome, so the child is a GIRL
    - ✓ Tails = Y chromosome, so the child is a BOY
    - ✓ Record the gender of your child on your data sheet.

2. Name your child with a first, middle, and last name. You should agree if your child will have the father's, mother's, or both parents last names. It is your choice!

3. Determine the child's facial characteristics by having each parent flip a coin.
    - ✓ Heads = child will inherit the first allele (i.e. B or N1) in a pair
    - ✓ Tails = child will inherit the second allele (i.e. b or N2) in a pair
4. On your data sheet, circle the allele that each parent will pass on to the child and write in your child's genotype.
5. Using the information in the phenotype/genotype guide, look up and record the child's phenotype and draw that section of the face where indicated on the data sheet.
6. Continue to move determine the genotype of each trait by following the data chart and flipping a coin as instructed.
    - ✓ Please note that some traits will follow special conditions which are explained in the phenotype/genotype guide.
7. When your data sheet is completed, each of you should 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.

Conclusion Questions (separate paper properly headed)

1. What percentage does each parent contribute to a child's genotype?
2. Define the term meiosis. Describe what represented meiosis in this lab.
3. Define the term fertilization. Describe what represented fertilization in this lab.
4. Using examples from this activity, explain your understanding of the following inheritance patterns:

a. dominant
b. recessive
c. incomplete dominance
d. polygenic
e. epistasis (you may have to look this word up!)

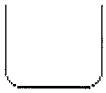
5. Compare the predicted phenotype ratio (Punnett squares) to the actual ratio (class data) for the following traits:
   a. trait # 2 (chin size)
   b. trait #8 (hair type)

Phenotype/Genotype Guide

1. **Face Shape**

Round: (AA, Aa)

Square: (aa)



2. **Chin Size** - the results of this genotype may affect the expression of the next two traits.

Very prominent (BB, Bb)

Less prominent: (bb)

3. **Chin Shape** – Only flip coins for this trait if chin size is very prominent. The genotype bb prevents the expression of this trait.

Round: CC, Cc)

Square: (cc)

4. **Cleft Chin** – Only flip coins for this trait fi chin size is very prominent. The genotype bb prevents the expression of this trait.

Present: (DD, Dd)

Absent: (dd)

5. **Skin Color** – To determine the color of skin or any other trait controlled by more than one gene, you will need to flip your coin for each gene pair. Dominant genes represent color. Recessive genes represent little or no color. For example, if there are 3 gene pairs:

   a. First flip determines if your child inherits E or e
   b. Second flip determines inheritance of F or f
   c. Third flip determines inheritance of G or g.

Your baby's skin color will be:

6 dominant genes: black
5 dominant genes: very dark brown
4 dominant genes: dark brown
3 dominant genes: medium brown
2 dominant genes: light brown
1 dominant gene: blonde
0 dominant genes: white

6. **Hair Color** – determined by 4 pairs of genes

8 dominant genes: black
7 dominant genes: very dark brown
6 dominant genes: dark brown
5 dominant genes: brown
4 dominant genes: light brown
3 dominant genes: brown mixed with blonds
2 dominant genes: blonde
1 dominant gene: very light blonde
0 dominant genes: silvery white

7. **Red Color Tints in Hair** – This trait is only visible if the hair color is light brown or lighter (4 or less dominant alleles for hair color)

Dark red tint: (L_1L_1) Light red tint: (L_1L_2) No red tint: (L_2L_2)

8. **Hair Type**

Curly: (M_1M_1) Wavy: (M_1M_2) Straight: (M_2M_2)



9. **Widow's Peak**

Present: (OO or Oo) Absent: (oo)


10. **Eye Color**

PPQQ: Black
PPQq: Dark Brown
PpQQ: Brown with green tints
PpQq: Brown
PPqq: Violet
Pqqq: Grey Blue
ppQQ: Green
ppQq: Dark Blue
ppqq: Light Blue

11. **Eye Distance**

Close: (R_1R_1) Average: (R_1R_2) Small: (R_2R_2)

12. **Eye Size**

Long: (S_1S_1) Medium: (S_1S_2) Small: (S_2S_2)

13. **Eye Shape**

Almond: (TT or Tt) Round: (tt)

14. **Eye Slantedness**

Horizontal: (UU or Uu) Upward Slant: (uu)

15. **Eyelashes**

Long: (VV or Vv)

Short (vv)

16. **Eyebrow Color**

Darker than hair color (W_1W_1)

Same of hair color (W_1W_2)

Lighter than hair color (W_2W_2)

17. **Eyebrow Thickness**

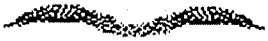
Bushy (ZZ or Zz)

Fine (zz)

18. **Eyebrow Length**

Connected: ($\mathcal{AA}$ or $\mathcal{A}a$)

Connected: (aa)



19. **Mouth Size**

Long: ($\mathcal{B}_1$ $\mathcal{B}_1$)

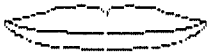
Medium: ($\mathcal{B}_{12}$ $\mathcal{B}$)

Small: ($\mathcal{B}_2\mathcal{B}_2$)

20. **Lip Thickness**

Thick: (CC or Cc)

Thin: (cc)



21. **Dimples**

Present: ($\mathcal{D}d$ or $\mathcal{D}d$)

Absent: (dd)

22. **Nose Size**

Large ($\mathcal{E}_1$ $\mathcal{E}_1$)

Medium ($\mathcal{E}_1$ $\mathcal{E}_2$)

Small ($\mathcal{E}_2$ $\mathcal{E}_2$)

23. **Nose Shape**

Rounded: ($\mathcal{F}\mathcal{F}$ or $\mathcal{F}f$)

Pointed (ff)

24. **Nostril Shape**

Round:(GG or Gg)

Pointed: (gg)

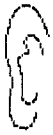
25. **Earlobe Attachment**

Present (HH or Hh)

Absent: (hh)

26. **Darwin's Earpoint**

Present: (*II or Ii*)



Absent: (*ii*)

27. **Ear Pits**

Present: (*JJ or Jj*)

Absent: (*jj*)

28. **Hairy Ears (males only)**

Present: (*KK or Kk*)

Absent: (kk)

29. **Freckles on Cheeks**

Present: (*LL or Ll*)

Absent: (*ll*)

30. Freckles on the Forehead:

Present (*MM or Mm*)

Absent: (*mm*)

The Genetics of Parenthood Data Sheet

Parents: Mom _____ Dad _____

Child's gender _____ Child's name _____

Fill in data table as you determine each trait described in the Guidebook. Do not simply flip the coin for all traits before reading the guide, because some traits have special instructions. It will really make your life easier if you follow directions. In the last column, combine the information and draw what that section of the child's face would look like.

Trait #	Trait	Allele from Mom	Allele from Dad	Child's Genotype	Child's Phenotype (written)
1	Face Shape	A a	A a		
2	Chin Size	B b	B b		
3	Chin Shape	C c	C c		
4	Cleft Chin	D d	D d		
5	Skin Color	E e F f G g	E e F f G g		
6	Hair Color	H h I i J j K k	H h I i J j K k		
7	Red Tints	L_1 L_2	L_1 L_2		
8	Hair Type	M_1 M_2	M_1 M_2		
9	Widow's Peak	O o	O o		
10	Eye Color	P p Q q	P p Q q		
11	Eye Distance	R_1 R_2	R_1 R_2		
12	Eye Size	S_1 S_2	S_1 S_2		
13	Eye Shape	T t	T t		
14	Eye Slantedness	U u	U u		
15	Eyelashes	V v	V v		
16	Eyebrow Color	W_1 W_2	W_1 W_2		
17	Eyebrow Thickness	Z z	Z z		
18	Eyebrow Length	A a	A a		
19	Mouth Size	B_1 B_2	B_1 B_2		
20	Lip Thickness	C c	C c		
21	Dimples	D d	D d		
22	Nose Size	E_1 E_2	E_1 E_2		
23	Nose Shape	F f	F f		
24	Nostril Shape	G g	G g		
25	Earlobe Attachment	H h	H h		
26	Darwin's Earpoint	I i	I i		
27	Ear Pits	J j	J j		
28	Hairy Ears	K k	K k		
29	Freckles on cheeks	L l	L l		
30	Freckles on forehead	M m	M m		