The Genetics of Parenthood—FACE LAB

The Genetics of Parenthood Guidebook Introduction

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.

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

Fill in the results on your data sheet.

Name the child.

Determine the child's facial characteristics by having each parent flip a coin.

* Heads = child will inherit the first allele (ie. B or N1) in a pair
* Tails = child will inherit the second allele (ie. b or N2) in a pair

Materials

* 2 coins (preferably different kinds to keep track of mother/father contribution)
* The Genetics of Parenthood Student Reference Sheets (attached) drawing paper or white boards
* Pens/crayons (Crayola has a "My World Colors" set for various skin/eye colors)

Traits:

1. FACE SHAPE:

 Round (AA, Aa) Square (aa)

2. CHIN SIZE: The results may affect 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.

4. CLEFT CHIN: 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) Present (DD, Dd) Absent (dd)



5. SKIN COLOR: To determine the color of skin or any other trait controlled by more than 1 gene, you will need to flip the coin for each gene pair. Dominant alleles represent color; recessive alleles represent little or no color. For example, if there are 3 gene pairs...

a. First coin toss determines whether the child inherits E or e.

b. Second coin toss decides F or f inheritance.

c. Third coin toss determines inheritance of G or g.

6 dominant alleles – black

5 dominant alleles - very dark brown

4 dominant alleles - dark brown

3 dominant alleles - medium brown

2 dominant - light brown

1 dominant - light tan

0 dominant - white

6. HAIR COLOR: Determined by 4 gene pairs (H, I, J, K). Follow the procedure for number 5.

8 dominant – black

7 dominant - very dark brown

6 dominant - dark brown

5 dominant – brown

4 dominant - light brown

3 dominant - brown mixed w/blonde

2 dominant – blond

1 dominant - very light blond

0 dominant - silvery white

7. RED COLOR TINTS IN THE 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 (L1L1) Light red tint (L1L2) No red tint (L2L2)

8. HAIR TYPE:

Curly (M1M1) Wavy (M1M2) Straight (M2M2)



9. WIDOW'S PEAK:

Present (OO, Oo) Absent (oo)



10. EYE COLOR:

PPQQ - black

PpQq - brown

ppQQ – green

PPQq - dark brown

PPqq- violet

ppQq - dark blue

PpQQ - brown with green tints

Ppqq - gray blue

ppqq - light blue

11. EYE DISTANCE:

 Close (R1R1) Average (R1R2)



Far apart (R2R2)

12. EYE SIZE:

Large (S1S1) Medium (S1S2) Small (S2S2)



13. EYE SHAPE:

 Almond (TT, Tt) Round (tt)



14. EYE SLANTEDNESS:

Horizontal (UU, Uu) Upward slant (uu)



15. EYELASHES:

Long (VV, Vv) short (vv)



16. EYEBROW COLOR:

Darker than hair Same as hair Lighter than hair

(W1W1) color (W1W2) color (W2W2) color

17. EYEBROW THICKNESS:

Bushy(ZZ, Zz) Fine (zz)



18. EYEBROW LENGTH:

Not connected (AA, Aa) Connected (aa)



19. MOUTH SIZE:

Long (B1B1) Medium (B1B2) Short (B2B2)



20. LIP THICKNESS:

Thick (CC,Cc) Thin (cc)



21. DIMPLES:

Present (DD, Dd) absent (dd)



22. NOSE SIZE:

Large (E1E1) Medium (E1E2) Small (E2E2)

23. NOSE SHAPE:

Rounded (FF, Ff) Pointed (ff)



24. NOSTRIL SHAPE:

Rounded (GG, Gg) Pointed (gg)



25. EARLOBE ATTACHMENT:

Free (HH, Hh) Attached (hh)

26. DARWIN'S EARPOINT:

Present (II, Ii) Absent (ii)

27. EAR PITS:

Present (JJ, Jj) Absent (jj)

28. HAIRY EARS: Males Only

Present (KK, Kk) Absent (kk)

29. FRECKLES ON CHEEKS:

Present (LL, Ll) Absent (ll)



30. FRECKLES ON FOREHEAD:

Present (MM, Mm) Absent (mm)



The Genetics of Parenthood—FACE LAB

Essential Question: How do Mendel’s laws relate to the genetic variation we see in sexually reproducing organisms?

Pre lab questions:

1. Compare and contrast the processes of mitosis and meiosis.
2. What are Mendel’s two laws? Describe them in your own words.
3. Define homozygous, heterozygous, genotype and phenotype in your own terms.
4. What other terms indicate a heterozygous genotype?
5. Define incomplete dominance in your own words. Give an example.
6. Define polygenic traits in your own words. Give an example.
7. What is crossing over? What is the outcome of crossing over?

The Genetics of Parenthood Data Sheet

Parents:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Child's gender genotype \_\_\_\_\_ Child's name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fill in the 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 of the traits have special instructions. In the last column, combine the information and draw what that section of the child's face would look like.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number | Allele from Mom (A or a) | Allele from Dad (A or a) | Child’s Genotype (AA, Aa, or aa) | Childs Phenotype (round or square) |
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Draw a picture of your child’s face in the space below:

Analysis questions:

1. Look at a couple of your neighbors children.
	1. Do you observe any that are identical to your child?
	2. Do you observe any children with a couple traits that are identical to your child’s phenotypes?
2. Explain why there is so much genetic variation among the children in your class.
3. Predict how the genetic outcomes and occurrence of similar traits would change if the parents started out with the mother being homozygous dominant for all traits and the father being homozygous recessive for all traits.
4. Calculate the probability of your child having the genotype AABbCcdd if both parents are heterozygous for all four traits.
5. Calculate the probability of your child having the dominant trait for traits A, B, C and D if both parents are heterozygous for all four traits.
6. If one parent has the genotype AaBBccDd what are all the gamete/sex cell possibilities at the end of meosis?