Human Genetics
Create -a- Face

Why do people look so different? Even close relatives often look very different. This happens because a large variety of traits exist in the human population and new variations are created as humans reproduce. The reasons that brothers and sisters have different genotypes (genetic messages on their DNA), and phenotypes (physical appearances) will be explored in this activity.

CONGRATULATIONS!! YOU ARE GOING TO BE A PARENT!!

You and your lab partner represent a couple who have ONE DOMINANT and ONE RECESSIVE gene for each facial feature illustrated in this lab. You are HETEROZYGOUS for each trait.

To find out the facial appearance of your child, you and your partner will each flip a coin to determine which bit of information - which GENE you will contribute to the child.

HEADS will represent DOMINANT TRAITS shown by capital letters.
TAILS will represent RECESSIVE TRAITS shown with small letters.

The flip of the coin will decide which trait of each pair you contribute to the child. The child gets **TWO** genes for each trait - **ONE** from **EACH** parent

PROCEDURE

1. Find out the sex of your child. Remember Mom's genotype is XX and Dad's is XY. So only Dad flips a coin. **Heads** represent a **Y sperm** and the child will be a boy. **Tails** represents a **X sperm** and the child will be a girl.

2. Give your bouncing baby a name.

3. Discover the baby's facial features.
* **Record** the genetic contribution, the coin flips, on the **face lab data sheet,** under the columns **Gene from mother , and Gene from father.**

Record the genetic message in the **Genotype** column, and **draw** the phenotype - what the trait will look like in the **Phenotype** column.

Example: **face shape:** Round: RR, Rr  Square (rr) 

Coins flipped: Mom : Heads (R) Dad: Tails (r) Genotype: Rr Phenotype : (round face)

4. Draw **YOUR CHILD'S MIDDLE SCHOOL PICTURE**
When you have determines all of the features for a particular structure, eyes for example, draw and color the way your baby will look when he/she has reached middle school age.

The Genetics of Parenthood Guidebook

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!

Several inheritance patterns are represented in this simulation, and it is important to review these with the students beforehand. *Inheritance of the traits used in this simulation have been simplified to serve as a model*; actual inheritance is far more complex and students may need to be reminded about this in case they become overly concerned about their own traits.

- Allele: form of a gene. For each gene there can be two alleles
- Phenotype: What the organism looks like (brown eyes, blue eyes)
- Genotype: What the alleles are for a trait (BB, Bb, bb)
- Dominant: allele which masks the expression of another; represented by capital letters (R, V)
- Recessive: allele which is expressed only if both parents contribute it; represented by small letters (r, v)
- Incomplete dominance: phenotype of the heterozygote is an intermediate form; represented by capital letters and subscripts (C_1, C_2); an example is red color tints in the hair
- Polygenic: several genes contribute to the overall phenotype; an example is skin color
- Sex-linked: commonly applied to genes on the X chromosome, the more current term is X-linked; genes on the Y chromosome are holandric genes; no examples in this activity
- Epistasis: one gene masking the effects of another; an example is hair color to red color tints

- Using the information in this guide, look up and record the child's phenotype and draw that section of the face where indicated on the data sheet.
- Some traits follow special conditions, which are explained in the guide.
- 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.

Features to be determined

1. Face Shape

Round: (RR Rr) 

Square (rr) 

2. Chin Shape

Prominent (VV, Vv) 

Less Prominent (vv) 

3. Chin Shape ONLY for Prominent Chin VV or Vv.

Round : RR , Rr 

Square: rr 

4. Cleft Chin:

Present (AA, Aa) 

Absent (aa) 

5. Skin Color:

Skin color involves 3 gene pairs. Flip your coins 3 time. A, B, and C
(For example : the first pair might be AA, Aa, or aa... record the first flip and then do 2 more...BB, Bb, bb and CC, Cc, and cc. Each capital letter represents an active gene for pigmentation, or color.

6 capitals - very dark BLACK skin
4 capitals - dark brown
2 capitals - light brown
0 capital - white
5 capitals - very dark brown
3 capitals - medium brown
1 capital - light tan

6. Hair Color

Like skin color, hair color is produced by several genes (polygenic or multiple alleles) Assume that 4 pairs are involved and flip the coins 4 times. A, B, C, D.

A, B, C, D: represent color or pigment
a,b,c,d : represent genes with little or no pigment

8 capitals - black
6 capitals - dark brown
4 capitals - light brown
2 capitals -blond
0 capital - white
7 capitals - very dark brown
5 capitals - brown
3 capitals - honey blond
1 capital - very light blond

7. Red Hair

Red Hair seems to be caused by a single gene with 2 alleles Red (R) or no red (r) and displays incomplete dominance. This means that a person with RR will have very dark red hair and Rr will be lighter red and rr will have no red in their hair.

Red hair is further complicated by the fact the brown will mask or hide the red color. The lighter The hair color in number 6 the more red that shows. If your child has 3 capitals or less for hair color and RR is tossed here, the child probably has flaming red hair or dark red hair.

8. Hair Type (Incomplete Dominance)

Curly (CC)  Wavy (Cc)  Straight (cc) 

9. Widow's Peak: The hair comes to a point in the center of the forehead

Present (WW, Ww)  Absent (ww) 

10-12: Eyebrow Traits: Do all 3 flips before drawing

10. Color: Very Dark (HH) Medium Dark (Hh) Light (hh)

11. Eyebrow Thickness:

Bushy (BB, Bb)  Fine (bb) 

12. Eyebrow Placement:

Not connected (NN, Nn)  Connected (nn) 

13-18: Eyes:

13. Eye Color: assume there are 2 gene pairs involved, the capital letters represent pigment or color and the lower case represent less color. Assume there are 2 layers of color on the iris of the eye. The first capitals represent the front of the iris and the second pair represent the back of the iris. Determine the first layer A then the second layer B.

AABB: dark brown AABb or AaBB: brown AaBb : Brown-hazel

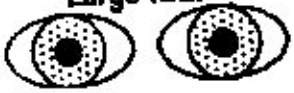
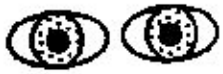
AAbb: dark blue aaBB : green Aabb : light blue aabb: pale blue

Note: In reality eye color is more complex that this

14. Eye distance apart:

Close together (EE)  Average distance (Ee)  Far Apart (ee) 

15. Eye Size:

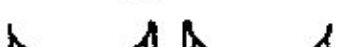
Large (EE)  Medium (Ee)  Small (ee) 

16. Eye Shape

Almond (AA, Aa)  Round (aa) 

17. Eye Slantedness

Horizontal (HH, Hh)  Upward Slanted (hh) 

18. Eyelashes: Long: (LL, Ll)  Short (ll) 

19-22: Mouth and Lip Traits

19. Mouth Size:

Long (MM)

Average (Mm)

Short (mm)

20. Lip Thickness

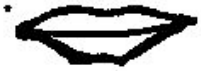
Thick (LL, Ll)

Thin (ll)

21. Lips Protruding

Very Protruding (HH)

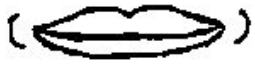
Lightly Protruding (Hh)



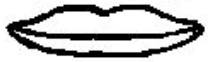
Absent (hh)

22. Dimples

Present (DD, Dd)



Absent (dd)



23-25: Nose do flips for 23, 24, 25 before drawing your nose

23. Nose Size:

Big (NN)

Medium (Nn)

Small (nn)

24. Nose shape:

Rounded (RR, Rr)

Pointed (rr)

25. Nostril Shape

Rounded (RR, Rr)

Pointed (rr)

26-30: Ear Traits

26. Earlobe Attachment
Free (Ff, Ff)

Attached (ff)

27. Darwin's Ear point
Present (DD, Dd)

Absent (dd)

28. Ear Pits
(Present (PP, Pp)

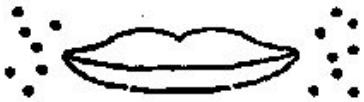
Absent (pp)

29. Hairy Ears : Hairy ear are sex-linked to the X chromosome and only occurs in males

Present (HH, Hh)

Absent (hh)

30. Freckles on Cheeks:
Present (FF, Ff)



Absent (ff)

31. Freckles on the forehead:

Present (FF, Ff)

Absent (ff)

Summary:
The traits in this activity were created to illustrate how human heredity works in a simple model. In real life the inheritance of facial features is much more complicated and is determined by the way several sets of genes work together.