

“Beaker Babies”

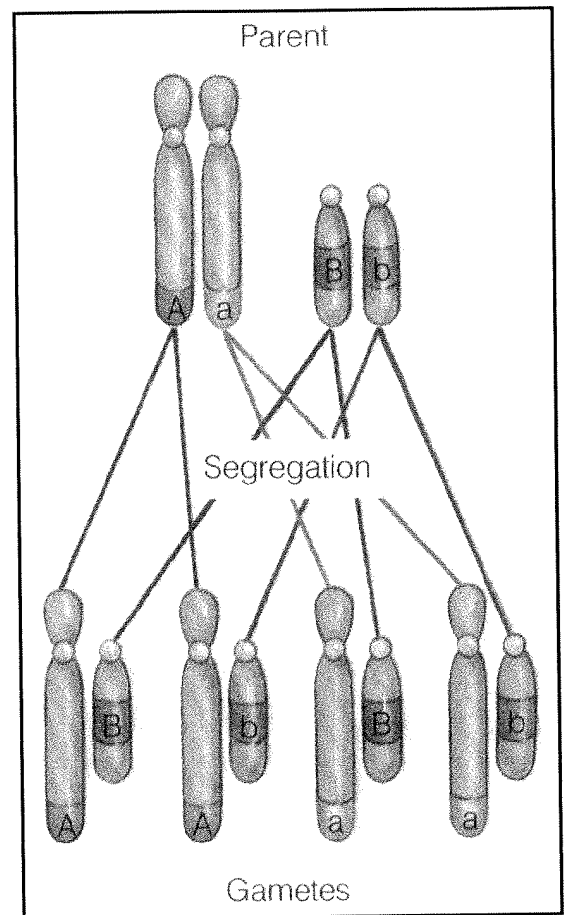
BACKGROUND:

Heredity is the passing on of traits, or characteristics, from parent to offspring. The units of heredity are called *genes*. Genes are found on the chromosomes in a cell. The combinations of genes for each trait occur by chance.

When one gene in a pair is stronger than the other gene, the trait of the weaker gene is masked, or hidden. The stronger gene is the *dominant* gene, and the gene that is masked is the *recessive* gene. Dominant genes are written as capital letters and recessive genes are written as lowercase letters. If both genes in a gene pair are the same, the trait is said to be *homozygous*, or *pure*. If the genes are not similar, the trait is said to be *heterozygous*, or *hybrid*. Sometimes genes are neither dominant nor recessive. The result of such a situation is a blending of traits.

The genetic makeup of an individual is known as its *genotype*. The observable physical characteristics of an individual that are the result of its genotype are known as its *phenotype*. In humans, the sex of an individual is determined by the particular combination of the two *sex chromosomes*. Individuals that have two *X* chromosomes (*XX*) are females, whereas those with an *X* and a *Y* chromosome (*XY*) are males.

In this activity, you will observe how the results of different gene combinations produced certain traits and investigate the process of *independent assortment* in gamete formation.



MATERIALS:

- Data Table containing genotype and phenotype information
- “Beaker Babies” Activity Sheet
- Photocopies of male and female gametes
- Two containers
- coin

PROCEDURE:

Part A: Determining Your Dominant and Recessive Traits (your genotype)

1. Determine the genotype (code) for your features using *Table #1* on the following page. Complete the last column of the chart by choosing the letter that fits your description. Use only ONE letter for each characteristic (i.e. *B* or *b*, not *BB* or *bb*)

TABLE #1: YOUR GENOTYPE

| CHARACTERISTIC | DOMINANT TRAIT | | RECESSIVE TRAIT | | YOUR CODE |
|------------------------|----------------|---|-----------------|---|-----------|
| 1. Hair color | Brown/black | B | Blonde/red | b | |
| 2. Hair texture | average | T | Thick/thin | t | |
| 3. Hair wave | yes | W | no | w | |
| 4. Length of eyelashes | long | M | short | m | |
| 5. Widow's peak | yes | P | no | p | |
| 6. Face shape | oval | O | other | o | |
| 7. Skin coloration | Black/average | S | Fair/reddish | s | |
| 8. Skin freckles | yes | F | no | f | |
| 9. dimples | yes | D | no | d | |
| 10. Eye color | brown | H | Blue/green | h | |
| 11. Ear size | average | A | Large/small | a | |
| 12. Eye shape | round | U | other | u | |
| 13. eyebrow | two | E | one | e | |
| 14. Ear length | long | I | Short | i | |
| 15. Attached ear lobe | yes | Q | No | q | |
| 16. Nose size | average | N | Small/large | n | |
| 17. Nose shape | straight | V | other | v | |
| 18. Lip shape | full | L | thin | l | |
| 19. Tongue curl | yes | K | no | k | |
| 20. Tongue roll | yes | R | no | r | |
| 21. Chin size | average | C | Small/large | c | |
| 22. Chin cleft | yes | G | no | g | |

Homework Check-sheet

| CHARACTERISTIC | FATHER | MOTHER |
|------------------------|--------|--------|
| 1. Hair color | | |
| 2. Hair texture | | |
| 3. Hair wave | | |
| 4. Length of eyelashes | | |
| 5. Widow's peak | | |
| 6. Face shape | | |
| 7. Skin coloration | | |
| 8. Skin freckles | | |
| 9. dimples | | |
| 10. Eye color | | |
| 11. Ear size | | |
| 12. Eye shape | | |
| 13. eyebrow | | |
| 14. Ear length | | |
| 15. Attached ear lobe | | |
| 16. Nose size | | |
| 17. Nose shape | | |
| 18. Lip shape | | |
| 19. Tongue curl | | |
| 20. Tongue roll | | |
| 21. Chin size | | |
| 22. Chin cleft | | |

Directions: Observe your parents and complete the above chart before proceeding with the remaining sections of this activity.

2. Complete **YOUR GENOTYPE** by comparing your dominant and recessive traits with your parent's traits. Using the homework check-sheet (*previous page*), determine your 2nd letter using the following rules:

- a) FIRST– write your **known** code from Part A, procedure 1 in the left-hand column in Table below.
- b) Since recessive traits are homozygous, write a small letter beside all your little letters.
(example: b b)
- c) If the first letter is a CAPITAL, compare your traits with those of your parents. If:
 - (1) both parents show the same trait as you, add a CAPITAL letter beside your first letter.
(example: C C)
 - (2) One or both of your parents don't have the same trait as you, add a small letter beside your capital letter. (example: C c)
- d) In space #23 put X X if you are a girl and Y X if you are a boy.

Part B: Forming an Egg or Sperm (Meiosis)

1. Your genetic code (genotype) has two letters for each trait. You may only pass on **ONE** of the two letters. (example: b, F, d, etc.) The baby may inherit the first or second letter based on the following rules:
 - a) Many genetic traits are inherited independently based on random chance (50 / 50).
 - b) Some traits are linked or connected. Connected traits must be inherited together in sets.
2. Prepare a slip of paper to represent your egg or sperm. (find it on teacher's desk) Make sure to put your name on it.
3. To determine whether the baby will inherit the first letter of your code or the second letter, flip a coin. If the choice is heads list the letter in the first column on the slip. If the coin is tails, list the letter in the second column on the slip.
4. Traits 11 and 14 are connected and 16 and 17 are connected.
5. Flip the coin for each trait until your slip has 23 letters on it. Fold up the slip and place it in the appropriated container in the front of the room.

YOUR GENOTYPE

| KNOWN LETTER From Part A | SECOND LETTER | YOUR GENOTYPE |
|--------------------------------|------------------|------------------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |
| 6. | | |
| 7. | | |
| 8. | | |
| 9. | | |
| 10. | | |
| 11. | | |
| 12. | | |
| 13. | | |
| 14. | | |
| 15. | | |
| 16. | | |
| 17. | | |
| 18. | | |
| 19. | | |
| 20. | | |
| 21. | | |
| 22. | | |
| 23. | | |

2. Repeat procedures 1 through 5 again and record the new egg or sperm in the second column of Table #2 ("YOUR CODE")

TABLE #2

*Part C: Forming the Zygote
(fertilization)*

1. To determine the genotype of your offspring, draw a slip at random from the container for the opposite sex.
2. Copy the letters listed on the slip in the third column of *TABLE #2* ("SLIP'S CODE")
3. Congratulations! The zygote is formed. A combination of your code + the slip's code (*other gamete*) will produce the baby's code (*the zygote*) To describe your baby, compare your baby's code to the traits listed on the chart in Part A. Then, complete the Birth Certificate. (the *phenotype*)

| BABY'S CODE (diploid) | YOUR CODE (haploid) | SLIP'S CODE (haploid) |
|--------------------------|------------------------|--------------------------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |
| 6. | | |
| 7. | | |
| 8. | | |
| 9. | | |
| 10. | | |
| 11. | | |
| 12. | | |
| 13. | | |
| 14. | | |
| 15. | | |
| 16. | | |
| 17. | | |
| 18. | | |
| 19. | | |
| 20. | | |
| 21. | | |
| 22. | | |
| 23. | | |

CONCLUSION QUESTIONS:

1. What is the probability of creating a boy or girl?
2. Which parent actually determines the sex of your child (male or female)?
3. What is Mendel's Law of Independent Assortment and how did it apply to this activity?
4. Why are traits 11 and 14 inherited together?
5. During meiosis, chromosomes often exchange parts of themselves with their neighboring chromosomes. What is this called?
6. Is it possible for you to show a trait that neither of your parents show? Explain
7. There have been cases in history when a king divorced his queen because she only produced daughters. Using your knowledge of genetics, explain why this is an incorrect move.
8. In this activity, you are dealing with 22 different genetic traits. How many genes make up the human genome?
9. Look at you and your partner's genotype for trait #1 (hair color) and create a Punnett square. What is the genotypic and phenotypic ratios of your offspring?
10. Look at you and your partner's genotype for trait #23 and create a Punnett square. What is the phenotypic ratio of the offspring?