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| Insect GENEration | Student Lab Exercise Logo |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_

Background

In this activity you will build an imaginary insect. The phenotype of this insect will be determined by its genotype. You will consider nine different traits, each of which is determined by a different gene. Each parent is heterozygous, or hybrid, for each of nine different genes. The record sheet on page 6 shows the “traits” and indicates which allele is dominant for each gene.

Since each parent is heterozygous for each gene, either allele may be passed on to any given reproductive cell (sperm or egg). You will flip a coin to represent the random process which determines whether a dominant or recessive allele gets passed on to the offspring. Since each parent passes on one allele for each gene, you will need to flip the coin *twice* for each gene being considered (or flip two coins at the same time). One side of the coin will represent the dominant allele (DOM) under consideration, while the other side represents the recessive allele (rec).

Write here which side will determine which allele:

Heads:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (DOM or rec)

Tails:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (DOM or rec)

Notice on the record sheet (page 6) that letter symbols are used to represent gene forms. Geneticists use capital letters to represent dominant genes, and lowercase letters to represent recessive genes. Each parent can contribute either a dominant allele **D** or a recessive allele **d**. There is a 50% chance that either the dominant allele **D** or the recessive allele **d** will be carried by each sex cell produced. The possible combinations of gene forms, or the *genotype*, and the phenotypes are shown in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Genotype** | **Genetic Term** | **Descriptive Term** | **Phenotype**  (trait that appears) |
| DD | homozygous dominant | pure dominant | dominant trait |
| dd | homozygous recessive | pure recessive | recessive trait |
| Dd | heterozygous dominant | hybrid | dominant trait |

An offspring inheriting the genotype **DD** or **Dd** will show the dominant trait phenotype since the dominant characteristic is the one expressed. An offspring inheriting the genotype **dd** will show the recessive trait phenotype.**Vocabulary Matching**

Match the following genetics terms to their proper definitions:

1. \_\_\_\_\_ dominant allele
2. \_\_\_\_\_ phenotype
3. \_\_\_\_\_ homozygous
4. \_\_\_\_\_ hybrid
5. \_\_\_\_\_ trait
6. \_\_\_\_\_ genotype
7. \_\_\_\_\_ gene
8. \_\_\_\_\_ heterozygous
9. \_\_\_\_\_ allele
10. \_\_\_\_\_ recessive allele
11. an individual’s observable traits, such as height, eye color, or blood type; outward expression of the genotype
12. a specific characteristic of an organism, which is passed from generation to generation
13. having two of the *same* allele for a trait
14. the allele that can be masked by another when present; these traits only appear in the phenotype if the genotype is heterozygous
15. an individual’s collection of genes, or, the two alleles inherited for a particular gene; genetic contribution to the phenotype
16. the genetic information for each form of a trait; one of two versions of a gene
17. having two *different* alleles for a trait
18. the basic physical unit of inheritance; passed from parents to offspring and containing the information needed to specify traits
19. having two *different* alleles for a trait
20. the allele that masks another when present; will always appear in the organism’s phenotype

**Materials**

Make sure you and your partner have all these materials before you start assembling your insect:

* 4 pushpins: 1 pair round, 1 pair longer ones
* 2 flat top thumbtacks
* 2 foam cylinders: 1 long, 1 short
* 12 colored toothpicks: 6 regular size, 6 cut in half
* 4 plain toothpicks, regular size
* 6 small squares of foam
* 1 Styrofoam™ egg
* 1 Styrofoam™ ball
* 4 pieces colored wire: 2 spiral pieces, 2 straight pieces
* 4 cut-out foam pieces (for wings): 2 pointy, 2 rounded
* 1 screw-in hook
* 2 pieces cut drinking straw: 1 long, 1 short
* 3 insulated staples
* Coins

**Procedure**

Look at the examplesin the student record sheet below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Traits**  **(DOMINANT or recessive)** | **Parent 1 Gene**  Check one box for each trait. | **Parent 2 Gene**  Check one box for each trait. | **Offspring Genotype**  Check one box for each trait. | **Offspring Phenotype**  Check one box for each trait. |
| **Humps**  TWO HUMPS or  three humps | ☐H  h | ☐H  h | ☐HH  ☐Hh  hh | ☐TWO HUMPS  three humps |
| **Antennae**  STRAIGHT or  spiral | N  ☐n | ☐N  n | ☐NN  Nn  ☐nn | STRAIGHT  ☐spiral |

For the hump trait, the genotype **hh** was checked since both of the parent coins landed with the recessive side up. Therefore the expressed characteristic or phenotype in this offspring will be the recessive three humps.

The **Nn** genotype was checked for the antennae trait since one parent coin landed with the dominant side up and the other parent coin landed with the recessive side up. The resulting phenotype is antennae that are straight. **NN** or **Nn** genotypes will code for the dominant characteristic.

Now, you and your partner will each get one or two coins with a gene form indicated for each side. When you toss the coin, it will land either **DOM** or **rec** side up. Two parent coins will be needed to determine the genotype for each trait. Check the dominant or recessive allele in the parent columns for each trait on the **Record Sheet on Page 5**. Then check one box in the offspring genotype column and phenotype column.

***After determining the phenotype for all nine traits, begin building your insect.***

**Building the Insect**

The insect should be constructed in such a way as to follow the general insect body plan as closely as possible. Remember to construct your insect based on the phenotypeinformation, NOT the genotype. Attach wings and legs to the middle body section of the insect: the thorax.

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| --- | --- | --- |
| **General Insect Body Plan** | | |
| **Head** | **Thorax** | **Abdomen** |
| Eyes | Three pairs of legs | Stinger *(if present)* |
| Antennae | Foot pads *(if present)* |  |
| Mouthparts | Wings |  |
|  | Humps |  |

|  |  |
| --- | --- |
| Thorax: | Use a foam cylinder, long or short. |
| Head: | Attach a Styrofoam™ ball to the thorax using a plain toothpick. |
| Antennae: | Attach spiral or straight wires to the head. |
| Eyes: | Fasten pushpins, either round or long, to the head. |
| Mouthparts: | Attach a piece of a plastic straw, long or short, to the head. |
| Legs: | Attach colored toothpicks, long or short, to the thorax. |
| Foot pads: | *If present*, attach small squares of foam to the legs. |
| Wings: | Wings are either round or pointy, cut from a foam sheet. Attach to the thorax using plain thumbtacks. |
| Abdomen: | Fasten a Styrofoam™ egg to the thorax with a plain toothpick. |
| Stinger: | *If present*, attach a screw-in hook to the abdomen. |
| Humps: | Attach either two or three insulated staples to the thorax. |

#### Parent 1: HhNnEeMmTtLlFfWwAa Parent 2: HhNnEeMmTtLlFfWwAa

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Traits**  Dominant in CAPITALS, recessive in lower case. | Parent 1. \_\_\_\_\_\_ (your initials)  Check one box for each trait contributed by this parent. | **Parent 2. \_\_\_\_\_\_**  (partner’s initials)  Check one box for each trait contributed by this parent. | **Offspring**  **Genotype**  Check one box for each trait for the corresponding genotype. | **Offspring**  **Phenotype**  Check one box for each trait for the corresponding phenotype. |
| **Thorax** | | | | | |
| **Thorax**  LARGE or small | * T * t | * T * t | * TT * Tt * tt | * LARGE * LARGE * small |
| **Legs**  LONG or short | * L * l | * L * l | * LL * Ll * ll | * LONG * LONG * short |
| **Foot pads**  PRESENT or  not present | * F * f | * F * f | * FF * Ff * ff | * PRESENT * PRESENT * not present |
| Humps TWO or three humps on thorax | * H * h | * H * h | * HH * Hh * hh | * 2 HUMPS * 2 HUMPS * 3 humps |
| **Wing shape**  ROUND or pointy | * W * w | * W * w | * WW * Ww * Ww | * ROUND * ROUND * pointy |
| **Abdomen** | | | | | |
| **Abdomen**  WITH or without stinger | * A * a | * A * a | * AA * Aa * aa | * ABDOMEN W/ STINGER * ABDOMEN W/ STINGER * abdomen without stinger |
| **Head** | | | | | |
| **Antennae**  STRAIGHT or spiral | * N * n | * N * n | * NN * Nn * nn | * STRAIGHT * STRAIGHT * spiral |
| **Eyes**  ROUND or long | * E * e | * E * e | * EE * Ee * ee | * ROUND * ROUND * square |
| **Mouthparts**  LONG or short | * M * m | * M * m | * MM * Mm * mm | * LONG * LONG * short |

Questions

1. Write down the complete genotype of your offspring insect:
2. How many traits expressed in the insect you built were *dominant* characteristics?
3. How many of these dominant characteristics were pure or *homozygous*?
4. How many traits expressed in the insect were *recessive* characteristics?

5. Would you expect more dominant or more recessive characteristics to appear in the offspring? Explain your answer.

1. Explain how it is possible that an offspring does not have round wings when both parents do have round wings.