

**SAMPLE LAB REPORT:
CONFIRMATION OF MENDEL'S LAW OF EQUAL SEGREGATION**

Introduction

Gregor Mendel crossed pure breeding strains of the garden pea, *Pisum sativum*, to determine the different forms appeared in the hybrids. When two pure breeding variations of a trait were crossed, only one form of the trait of the pair was evident in the F1 progeny. Mendel called this the **dominant** trait. The other variation that was hidden was called the **recessive** trait. When the F1 progeny were self-fertilized, the resulting F2 progeny always appeared in a 3:1 ratio of dominant to recessive phenotypes. From these results and further crosses, Mendel hypothesized that the factors that determine the variation in the traits segregate from each other in equal numbers into gametes and that each gamete carries only one of the factors. These factors are now known as genes and the different forms of the factors are known as alleles. Mendel's hypothesis was confirmed and has become known as Mendel's Law of Equal Segregation. In this lab, we tested Mendel's Law of Equal Segregation by crossing pure breeding strains of *Drosophila melanogaster* that varied in eye color, a trait encoded for by a single gene pair. This cross and the subsequent crossing of the F1 progeny was performed to determine if this gene pair obeyed Mendel's Law.

Materials and Methods

Parental cross for examination of Mendel's Law of Equal Segregation: 5 female virgin sepia-eyed (se/se) *D. melanogaster* were obtained by removing all eclosed flies from the stock vial and then harvesting all the flies that eclosed in the next 8 hours. The eclosed flies were anesthetized with FlyNAP (Carolina Biological Supply), examined, and the females were obtained. 4 male red-eyed (se^+/se^+) flies were anesthetized with FlyNAP, examined, and placed with the 5 sepia-eyed virgin females in a fresh vial of standard *Drosophila media* (Carolina

Biological Supply). This cross was designated: *se/se* virgin females X *se⁺/se⁺* males. The vials were incubated at room temperature. The parental flies were discarded 10 days after the cross was set up, and the F1 progeny that hatched were scored for eye color 21 days after the cross was set up.

F1 cross for examination of Mendel's Law of Equal Segregation: A cross of the F1 flies from above was set up as follows: 5 F1 males and 5 F1 females were placed into a fresh vial of *Drosophila media*. The vials were incubated at room temperature. The F1 flies were discarded 7 days after this cross was set up, and the F2 progeny that hatched were scored for eye color 21 days after the cross was set up.

Results

To test Mendel's Law of Equal Segregation, we examined the inheritance of eye color by crossing two pure breeding strains of *D. melanogaster* with different eye color phenotypes - red and sepia. We determined which allele was dominant by setting up the cross *se/se* virgin females X *se⁺/se⁺* males as described in the Materials and Methods. The phenotypes of the progeny are shown in Table 1.

Table 1: Phenotypes of the F1 progeny

| Phenotype | number of progeny | | |
|------------|-------------------|---------|-------|
| | Males | Females | Total |
| Red eyes | 43 | 56 | 99 |
| Sepia eyes | 0 | 0 | 0 |

To further examine whether eye color was inherited according to Mendelian laws, we crossed the F1 progeny and examined the phenotypes of the resulting F2 flies (Table 2).

Table 2: Phenotypes of the F2 progeny

| Phenotype | number of progeny | | |
|------------|-------------------|---------|-------|
| | Males | Females | Total |
| Red eyes | 40 | 46 | 86 |
| Sepia eyes | 13 | 11 | 24 |
| | | | 110 |

To determine the statistical relevance of our data, we performed the Chi² Test on our F2 data (Table 3).

Table 3: Analysis of the F2 progeny using the Chi² Test

| Class | Observed | Expected | (O-E) ² | (O-E) ² /Expected |
|------------|----------|----------|--------------------|------------------------------|
| Red eyes | 86 | 82.5 | 12.25 | 0.148 |
| Sepia eyes | 24 | 27.5 | 12.25 | 0.445 |
| totals | 110 | 110 | | Chi ² = 0.593 |
| | | | | df=1, 0.5 > p > 0.1 |

Discussion and Conclusions

The results of the parental cross (se/se virgin females $\times se^+/se^+$ males) demonstrate that the wild-type allele (se^+) is dominant to the allele for sepia eyes (se) as no sepia-eyed progeny were seen in the F1 progeny (Table 1).

Calculations from the F2 data (Table 2) show that the ratio of red-eyed to sepia-eyed flies is 3.58:1. Although this ratio is very close to the expected 3:1 ratio for a monohybrid cross, the χ^2 test was performed to determine whether this experimental data differed significantly from the 3:1 ratio expected for a simple monohybrid cross (Table 3). The results of the χ^2 test suggest that the experimental data do not differ significantly from the expected 3:1 ratio. Specifically, there is between 10% and 50% probability that the differences seen are due to chance. In this case, the differences seen are probably due to the small sample size scored from the cross.

In conclusion, the phenotype of the F1 progeny confirmed that the allele for the wild-type red eyes, se^+ , is dominant to the allele for sepia eyes, se . The ratio of red-eyed to sepia-eyed flies of 3.58:1 seen in the F2 is very near that of the expected 3:1 ratio for a monohybrid cross, and the χ^2 test verifies that it is within statistical limits. Therefore, the results of this experiment confirm Mendel's Law of Equal Segregation.