
Genetics Construction Kit (GCK)

Overview:

The Genetics Construction Kit (GCK) allows you to simulate extensive genetic experiments without investing the months or years of hard work it would take in reality. The data you will generate is 'real' in the sense that it has all the ugly warts, odd habits and weird problems that real data has. In addition, it does not come with an instruction book as to how to interpret it. For this exercise we want you to pretend that you are a new research student about to embark on an amazing journey.....

Imagine that...

It's the early 1900's and you have just begun working in Thomas Hunt Morgan's lab, shortly after the rediscovery of Gregor Mendel's work. Morgan is interested in the properties of heredity, but is somewhat skeptical that Mendel's laws of inheritance apply to *all* plants and animals. Therefore Morgan asks you to assist him by testing Mendel's laws using the fruit fly *Drosophila*, a rapidly reproducing insect that he thinks will be an excellent organism for studying inheritance.

Assignments:

You will simulate genetic crosses of *Drosophila* using computer software called the Genetics Construction Kit (GCK). This software also allows you to record and analyze your results more easily. A class presentation will take you through the basics of simulating and analyzing crosses using the GCK software. For further instructions, you can consult the GCK User's Guide (available online from the Bio 220 Home Page).

Over the next few weeks, you must thoroughly analyze Bio 220's GCK #1 and #2. You must test to see if your *Drosophila* variations follow Mendel's laws of inheritance, and if they do not, you must provide likely explanations.

GCK Pre-lab Questions: Your type-written responses to these questions are due at the start of lab in Week 6.

Before you start GCK #1, it will be helpful to think about Mendel's experimental design. We suggest that you then follow his design as closely as possible during your investigations.

1. Before Mendel performed his "experiments in plant hybridization", what did he do first? Why? (Hint: See question 5 from last week.)
2. What experiments did Mendel perform to demonstrate that...
 - a. the mother and father make an equal contribution to the offspring?
 - b. one form of a gene can be dominant to a second form of the gene?
 - c. each gene exists in pairs that equally segregate during gamete formation?
 - d. the inheritance of one gene pair is independent of a second gene pair?

GCK#1 Content Questions: Your *type-written* responses to these questions are due by 5 p.m. on Friday of Week 6.

1. Mendel conducted his studies with pure-breeding strains. How did you produce parents that were true-breeding? How did you confirm this?

The objective of your work was to test if Mendel's rules of inheritance, which are summarized in GCK Pre-lab Question 2 (above), also apply to an animal.

Section A. Consider Mendel's first rule, that the mother and father make an equal contribution to the offspring (GCK Pre-lab Question 2a).

- A1. *Summarize* the results of your experiments that tested this rule in *Drosophila*. If your data are complex, summarize them in a properly prepared table or figure. Again, summarize as efficiently as possible; do not present raw data.
- A2. What results did you expect to see according to Mendel's work (this is your null hypothesis)?
- A3. How did your results compare to these expectations? Were they significantly different?
- A4. If your results are significantly different than you expected, suggest a possible explanation. You may want to consult the *Cartoon Guide to Genetics* and other sources. If possible, design a test of your hypothesis and perform the test using GCK.

Section B. Consider Mendel's rule that one form of a gene can be dominant to a second form of the gene (GCK Pre-lab Question 2b). Answer the questions in Section A above, numbering your responses B1 - B5.

Section C. Consider Mendel's rule that each gene exists in pairs that equally segregate during gamete formation (GCK Pre-lab Question 2c). Answer the questions in Section A above, numbering your responses C1 - C5.

Section D. Consider Mendel's rule that the inheritance of one gene pair is independent of a second gene pair (GCK Pre-lab Question 2d). Answer the questions in Section A above, numbering your responses D1 - D5.

GCK#2 Content Questions: Your *type-written* responses to these questions are due by 5 p.m. on Friday of Week 7.

Repeat your analysis for GCK#1, sections A-D, for the traits that you studied in GCK 2.