The Virtual Genetics Lab

Learn Genetics by Doing Genetics

With VGL, your students can:

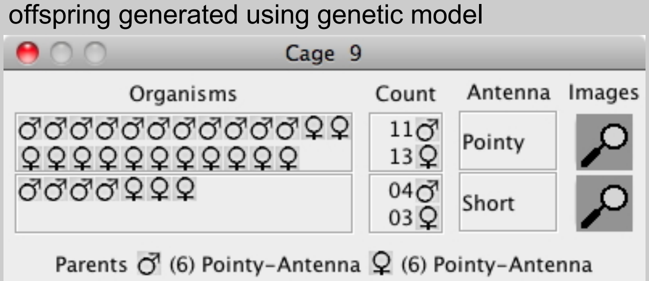
- *learn* genetics concepts by discovery
- *reinforce* genetics concepts with inquiry
- develop and test *hypotheses*
- construct *scientific arguments*
- *present* and *critique* data

VGL problems are customizable:

- every problem is different (traits & genetic model)
- problem difficulty can be set by instructor
- simplest models are simple dominance
- more complex models include sex-linkage
- most challenging models include linkage & recombination

Students work with Cages of Simulated Organisms:

- deduce the underlying genetic model from data
- click to select two parents, then click CROSS
- offspring generated using genetic model



- optional practice mode shows model and genotypes

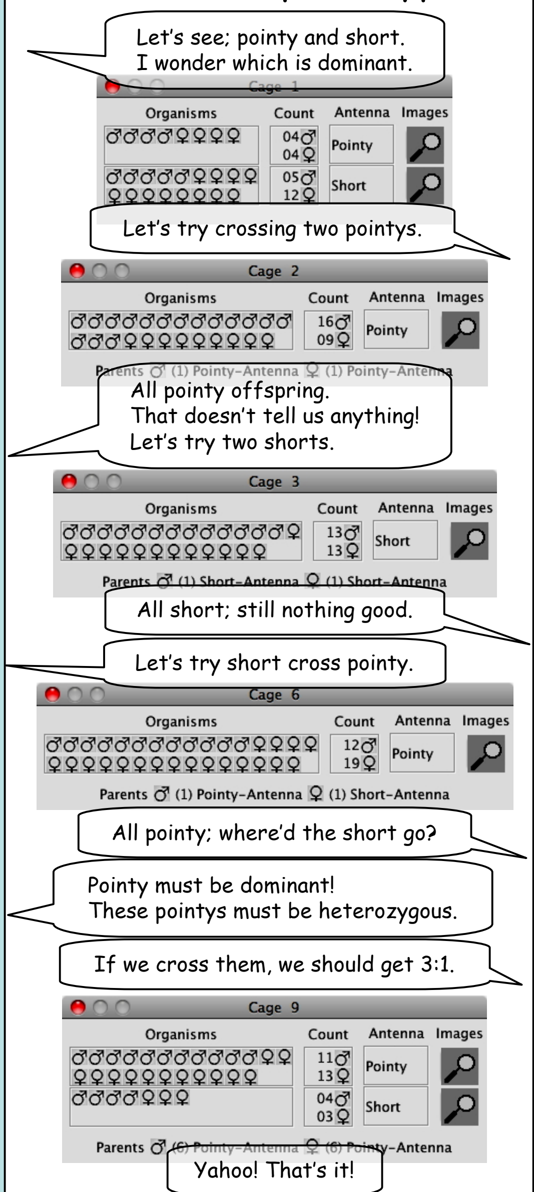
VGL is widely-used and well-tested:

- used with over 3000 college students since 2003
- used in many colleges and high schools
- used in US and internationally
- available in English, French, and Spanish

VGL is free and open-source:

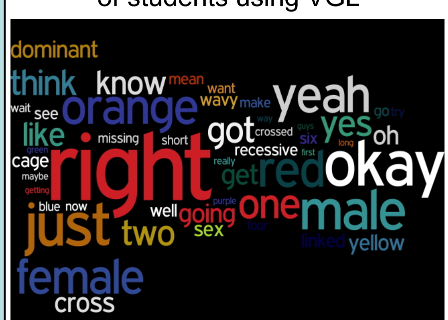
- download from http://intro.bio.umb.edu/vgl/
- lab manuals and other materials free on-line
- videos and documentation also on-line
- written by Brian White (brian.white@umb.edu)

A tale of two phenotypes...



(a dramatization)

Wordle made from transcripts of students using VGL



{Sample full-credit lab report produced by freshman undergraduate in General Biology I at UMass Boston}

Abstract

The genetic model is sex-linked (XX/XY) incomplete dominance. Three phenotypes are present: orange eyes, blue eyes, and red eyes.

Introduction

The research question being addressed is how do we figure out if a model is sex-linked (XX/XY) incomplete dominance. We can answer that question by crossing individual organisms and looking at the offspring that they produce. This is effective because by doing this, we can tell which alleles are getting passed to the offspring by looking at their phenotypes. We can also tell what the parents' and offspring's genotypes are with enough crosses because the different phenotypes present in the offspring can tell us about simple dominance or incomplete dominance. To determine if the model is sex-linked (XX/XY), we can look at the number of males and females present in the offspring. If a few of the crosses show that males or females are not present in the offspring, it can be determined that the model is sex-linked (XX/XY).

Materials and Methods

We did five crosses total. Three of these crosses were needed to figure out that the genetic model was sex-linked and one was needed to figure out that it was incomplete dominance. Three crosses were needed to figure out which genotype was heterozygous. No red eyed males were present in any of the models, so that was the first indication that the model was sex-linked. Also, one of the crosses had no orange eyed females and two of them had no blue eyed males. To figure out it was incomplete dominance, we crossed two different phenotypes and got all three phenotypes in the offspring. To figure out which phenotype was heterozygous, we needed to cross each of the phenotypes with themselves (we couldn't do that with the red eyed bugs though since there were no red males) and then figure out which genotypes were homozygous. Then we needed to cross two different phenotypes with each other to see which genotype was heterozygous.

Results and Discussion

The genetic model is sex-liked (XX/XY) with incomplete dominance.

allele	contribution to phenotype
X^DX^D	orange eyed female
X^dX^d	blue eyed female
X^DX^d	red eyed female
X^DY	orange eyed male
X^dY	blue eyed male

To prove that the model is sex-linked (XX/XY), there were no red eyed males in the model, showing that it could not have been sex-linked (ZZ/ZW) since the males in that model would be the ones displaying all phenotypes present and the females in that model would not be able to show all three phenotypes since it is incomplete dominance and must be heterozygous for one of the traits. In the second cross that we did (an orange eyed male x a red eyed female) we got four red eyed females, eleven orange eyed males, eight orange eyed females, and seven blue eyed males. There were no blue eyed females present and no red eyed males present. This showed that the model was sex-linked (XX/XY) since some males and some females were not given.

To prove that the model is incomplete dominance, we crossed two orange eyed bugs and got all orange eyed offspring. We did the same with blue eyed bugs and only got blue eyed offspring. This showed that those two phenotypes didn't have heterozygous genotypes, since no other phenotype was present in the offspring. However, when we crossed an orange eyed male with a red eyed female, all three phenotypes were present in the offspring, proving that the red eyed genotype was heterozygous. The model could not have been simple dominance since there three phenotypes present, and not just two.