Exploring ways to overcome misconceptions about genetic linkage and molecular markers

Jennifer Klenz and Lisa McDonnell

Department of Zoology

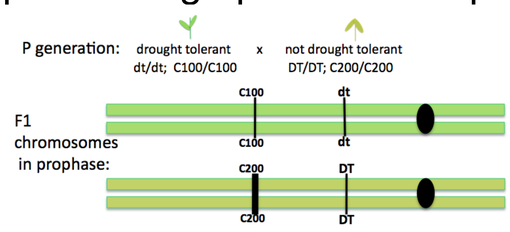
DEPARTMENT OF BOTANY

Goals

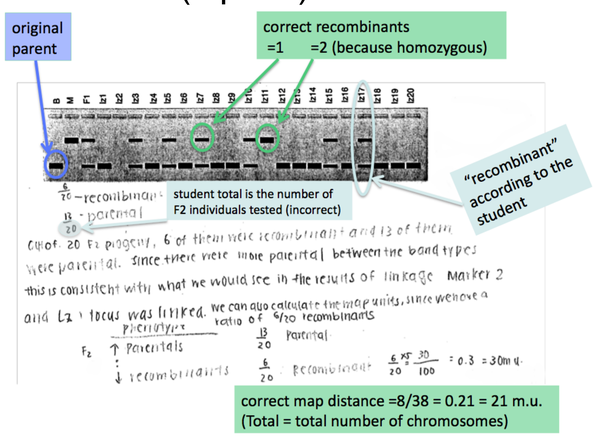
Goals:
Help students connect the events in meiosis, to the final banding pattern we observe in a mapping with molecular markers experiment.
1.Capture common student errors
2.Explore the impact on student understanding of:
• two tutorial exercises: ill-defined vs. well-defined scaffold problems.
• combination of an in-class exercise and an ill-defined tutorial problem

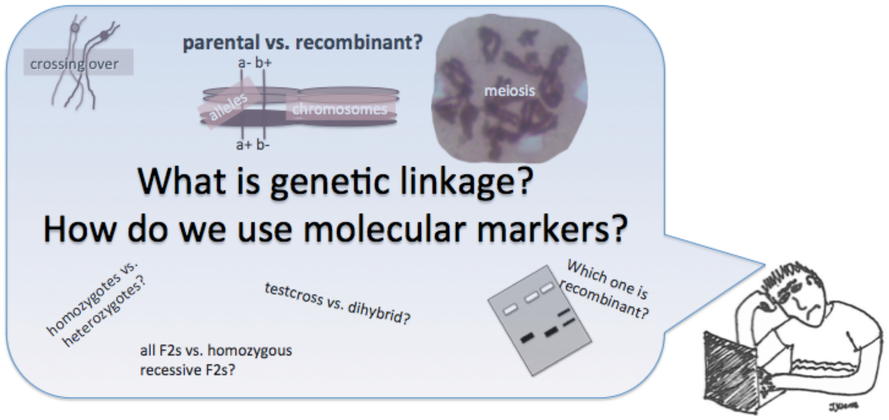
Common Confusions

A typical linkage problem setup:



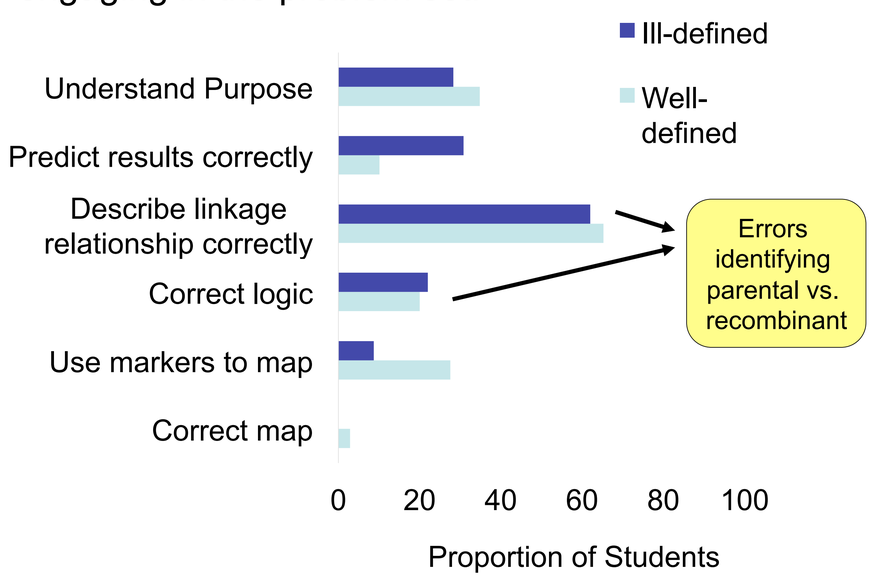
-Students have difficulty recognizing which F2 phenotypes are parental vs. recombinant (60% after peer discussion and instruction n=385)
-When scoring they count individual lanes rather than considering each lane contains data from two chromosomes (diploid)





Intervention #1

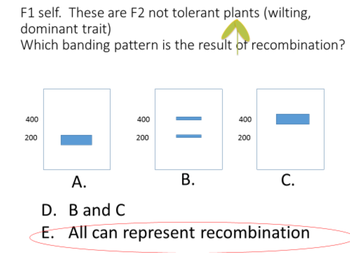
Students were separated into two groups and worked on a problem set that was either:
1) Scaffolded, well defined problem (n=68)
2) Scaffolded, ill defined problem (n=92)
All students wrote the same post-test after engaging in the problem set.



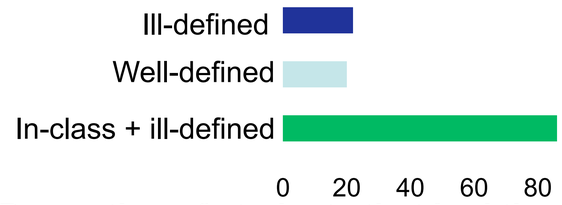
Post-test results. No difference was observed in the effects of the well- and ill-defined exercise. Students are good at identifying genetic linkage using banding patterns, but struggle with connecting bands on a gel to alleles on chromosomes, and how bands represent recombination events.

Intervention #2

Only 30% of students selected the correct answer after instruction



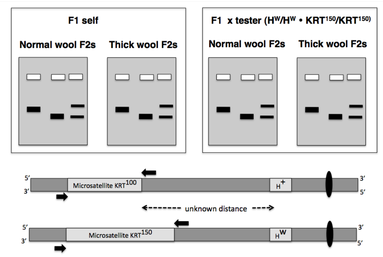
An in-class prediction activity combined with instructor feedback, and followed by the ill-defined problem in tutorials improved student understanding regarding what the banding patterns represent.



Proportion of students that had the correct logic to determine the linkage relationship correctly

Remaining Challenges

Students had to identify which bands shown could represent possible scorable recombinants or parentals from a dihybrid vs. testcross from a given scenario



35% of students still struggle with recombination when the phenotypes scored are bands on a gel (n =52).
We believe improvement requires even more class time, which includes activities where students make connections between meiosis and banding patterns.

jklenz@botany.ubc.ca @LMcD4 lmcdonne@zoology.ubc.c
www.blogs.ubc.ca/lisamcdonnell