Teaching Notes

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**Course Information**

Department: **Biology**

Level: **Lower Undergraduate**

Course type: **Lab**

Students: **Majors (Biology, Psychology)**

Number of Students: **7**

**Module Information**

Original Module Name: A Structured Inquiry Approach to Cotyledon Phenotyping

Link to Original: <https://qubeshub.org/qubesresources/publications/428/1>

Modified Module Name: no change

Files associated: (ie. Class Worksheet, Summative Quiz, Lecture Powerpoint, etc)

* Class worksheet to summarize experiment

Modification Learning Goals:

* Use genetic analysis techniques to determine the likely genetic control of a discrete trait
* Discuss how actual experiments differ from textbook problems
* Perform and interpret a chi-squared test

**Teaching Notes**

*(Think about what you would like to read about this activity if you came back to it in 2 years)*

Suggestions for this section (not all required, and extras always welcome):

* What did you change and why?
	+ I used the tobacco seeds (incomplete dominance), the sorghum and the corn (lethal)
	+ I provided little feedback on their hypotheses despite the crazy complexity they came up with. I felt this would better demonstrate the importance of starting out with a simple hypothesis.
	+ We had to use multiple petri dishes for the groups with larger seeds (corn and sorghum)
	+ I have them fill out an experiment summary sheet as they went along. This is basically the important points of a lab report.
* How did the activity go?
	+ What went well and why?
		- The students enjoyed the activity, despite its simplicity.
		- It was clear from my discussions with them that they didn’t really understand why you use a chi-squared test until after they made their hypothesis.
	+ What went wrong and why?
		- The complexity of the hypotheses was surprising to me – 2 out of the 3 groups hypothesized that it would be an epigenetic interaction.
		- There was confusion about what was the cotyledon for the monocot seeds. I don’t think the corn was not correctly phenotyped because it wasn’t as far along as it needed to be.
		- The group with the tobacco seeds had issues seeing that there were 3 phenotypes because 1) the plants are super tiny at that points and 2) the variation is slight. I had to prompt them to look at how much variation there seemed to be in their categories. This might be something to talk to them while they are designing the experiment – how are you going to decide on what is one phenotype vs another?
		- The corn seeds quickly became very stinky. I had to add more water to the corn initially because it didn’t seem to be absorbing enough through the filter paper. This might have delayed them by a couple of days. After the activity I planted them and the white ones lasted about 2 weeks before dying.
		- Groups of 2 are best for this – there isn’t enough work from more than 2 people.
* What was the prep like?
	+ How much time went into prep?
		- 20 min – putting ~100 seeds in each envelope.
	+ Did you have to do any prep (i.e. grow cultures, grow seeds, order supplies) ahead of implementation?
		- Order supplies (petri dishes, seeds)
* Would you do this activity again?
	+ Despite its simplicity I would use this activity again.
		- I think it helps students understand how even simple traits are actually not as straightforward as the textbook makes them seem.
		- It helps them feel like geneticist and hopefully connect the problems we do in class with how actual genetics is done.
		- It shows the usefulness of statistical tests – the tobacco group had what looked to be an unexpected ratio of phenotypes, but the chi-squared test did not reject a single gene. It also demonstrated the importance of a large sample size.
* What would you change in the future?
	+ It was difficult for the students to come up with hypotheses based on basically no information. However, I am not sure how to address this without removing some of the discovery that they do in the actual lab.
	+ Maybe a follow up question about how this variation will affect the plant short term and long term, what experiments we could do to test these hypotheses.
* What do you wish you’d known before you ran the activity?
	+ The corn needs lots more water than I was expecting.
	+ 2 people per group is best.
	+ Hand lenses or dissecting scopes for the tobacco seeds.
* Is there anything else you would like to make note of?
	+ It took them about 25ish minutes to figure out their hypothesis, rationale and expected results.
	+ The germination rate for the corn was low, about 50%.
	+ The sorghum grew the fastest – I had to open up the petri dishes so they weren’t squished.
	+ Tobacco plants are very small after only 1 week.