Supplemental Material

S1. A portion of interview transcript from a student think-aloud interview capturing work-checking. This student began with an incorrect hypothesis, but engaged in work-checking and realized an error. Most students demonstrated steps i-v, but did not engage in checking (steps vi onward).

Question: A female mouse with brown fur mated with a male mouse with brown. All the female offspring had brown fur, half the male offspring had brown fur and the other half of the male offspring had yellow fur.

a. Determine the mode of inheritance and any dominance relationships that exist. What are the parental genotypes?

i. *Student reading the question* ii. *"maybe it's (white) Y-linked because there is a difference between males and females"* iii. *"dominant"*	**Forming a hypothesis**
iv. *Writing out parental genotypes* v. *Writing out a cross to generate F1 genotypes*	**Applying hypothesis to generate answer**
vi. *Predicting F1 phenotypes based on genotypes (all brown)* vii. *"wondering if this is wrong"* viii. *Considering different alleles (white allele is X-linked recessive)* ix. *doing a cross and checking the F1 phenotypes to what was given in the question.* x. *Decides that X-linked recessive is correct.*	**Checking:** Comparing results of applying hypothesis to the expected (results given in the question). Realized a discrepancy. Revised hypothesis, checking revised hypothesis.

S2. A test question that was used to assess students on their work-checking:

20 marks. A population of mice being used for research are known to have a heritable form of a disease called ALS. ALS is caused by motor-neuron degeneration in the brain and spinal cord, a debilitating and almost always fatal disorder. These mice were crossed to another strain of mice that exhibits other symptoms associated with neuromuscular disease such as extreme muscle stiffness in the legs. The offspring of a cross between an ALS mouse with a stiff-legged mouse were further inter-crossed to investigate the inheritance of these conditions and determine if there is any interaction between the ALS gene and the gene involved in the stiff-leg phenotype.

Analyze the cross below. **Use the subsequent blank page (page #7) to show all of your work.**

If you eliminate a hypothesis while working on the problem, don't erase your work, simply put an "X" through it. When solving, please use the following symbols:

a- ALS	a+ no ALS
s- stiff legs	s+ normal legs

Cross:	Female mouse no ALS, stiff legs	x	Male mouse with ALS, normal legs
Offspring:			

Females: All have ALS, ½ stiff legs, ½ normal legs

Males: None have ALS, ½ stiff legs, ½ normal legs

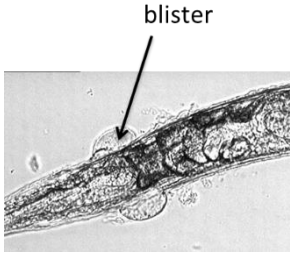
Once your work is done (on blank page #7), complete the following:

a. What is your hypothesis about the mode of inheritance for both of these traits?

b. What work did you do to show your hypothesis is correct? Highlight the work you did and explain (in one or two sentences) how it shows your hypothesis is correct.

S3. An example of a students' work-checking and iteration on the post-intervention quiz. Students were given the question on a handout and instructed to write their answer on carbon paper. A photo of a student's carbon paper submission is shown below the question.

QUIZ QUESTION: You identify an uncoordinated (unc) mutant of *C. elegans,* one that exhibits a severe twitching behaviour. This unc worm also exhibits another phenotype called blistering (it develops a blister on the cuticle). This uncoordinated, blistered worm (unc, bli) is crossed with another worm that has a wild-type phenotype to create an F1 population. Eighteen F1 are screened for phenotypes. All of the F1 are blistered, but the uncoordinated phenotype varied: 10 exhibited a less-severe uncoordinated behaviour (they twitch, but it's not as severe as the unc

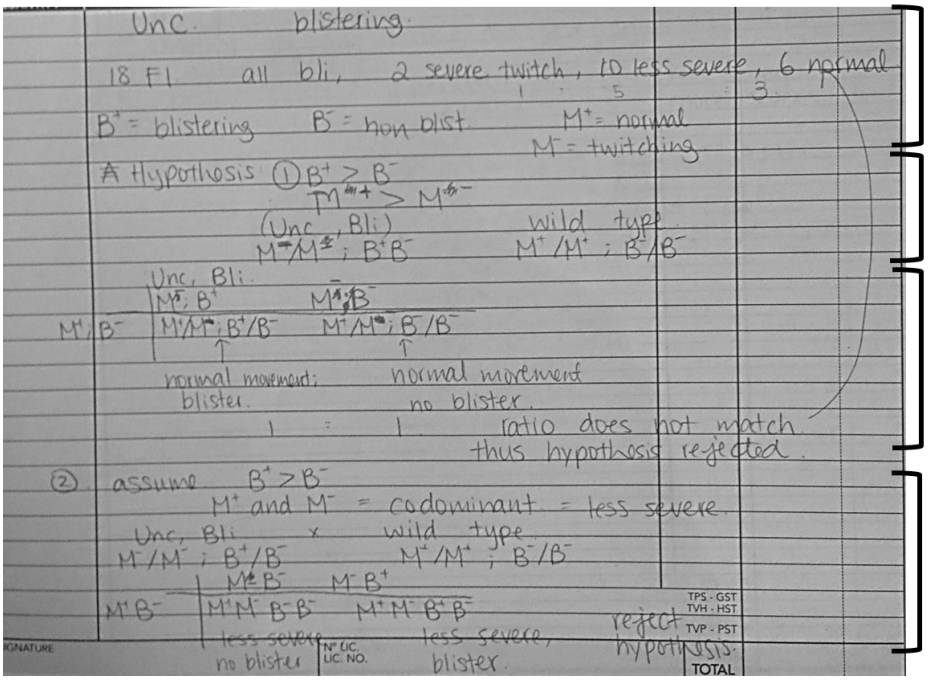


parent), 6 exhibited normal movement (no twitching), and 2 exhibited the severe twitching behaviour (severity of twitching was the same as the unc parent).

a. Based on this information, what would you conclude about the inheritance of the uncoordinated and blistering traits? Be sure to include genotypes of the worms.

*Be sure to **show all of your work:** Identify your first hypothesis and the work you did to prove your hypothesis is likely correct. If you original hypothesis doesn't work, identify why it didn't work, your second hypothesis, and the work you do to check a second hypothesis.*

Example of student work:



Organizing information given in the problem set-up

Articulating first hypothesis

Checking by testing hypothesis and comparing results to given information → realizes inconsistency

Articulating a revised hypothesis, checking, rejecting