

California Blackworm Lab

Created and delivered by **Clarissa S. Gomez**, Biology M.S. candidate
Prepared for Ross Middle School Grade 6, El Paso, Texas, November 2006

TEKS Objective

6.5 Scientific concepts. The students know that systems may combine with other systems to form a larger system. The student is expected to:

- A. identify and describe a system that results from the combination of two or more systems such as in the solar system; and
- B. Describe how the properties of a system are different from the properties of its parts.

References

California Blackworms Curriculum:

<http://coep.pharmacy.arizona.edu/curriculum/blackworms/index.html>

Southwest Environmental Health Sciences Center

University of Arizona College of Pharmacy, Room 244

PO Box 210207, Tucson, AZ, USA 85721-0207

swehsc-info@pharmacy.arizona.edu

520-626-5594

520-626-6944(FAX)

Lesson Vocabulary

Due to the short period of time, the students were prepped a day in advance using a KWL with seven vocabulary words that will be incorporated into the lab. The vocabulary words will be discussed and reviewed the day of the lab in order to get an idea of what the students believe the words mean. This lab resembles the research that is conducted in Dr. Bain's environmental toxicology lab. Because Arsenic and mice cells cannot be brought to the school the experiment involved dilutions of alcohol which represented the concentrations of As (Arsenic); the worms will represent the mice cells. I briefly incorporated and explained to the students what As is and its affects on mice cells when they are exposed to different concentrations of it with a short **PowerPoint presentation** that I presented after the vocabulary words were discussed. The following is an example of the KWL given to the students a day prior to the lab:

Vocabulary Words	What I K now	What I W ant to Know	What I L earned
Toxicology			
Hazard	<i>Students completed</i>	<i>Students completed</i>	<i>Students completed</i>
Toxin	<i>this portion a day</i>	<i>this portion a day</i>	<i>this portion after they</i>
Indicator	<i>before the lab as</i>	<i>before the lab as</i>	<i>completed the lab</i>
Dilution	<i>Homework</i>	<i>homework</i>	
Control			
Arsenic			

Materials Required

PowerPoint presentation (**PPT**) entitled “Toxicity Lab with Worms”

Materials for preparation before lab:

- KWL sheet (provided by teacher the day before lab)
- alcohol solution (stock – 450mL water + 50mL alcohol)
- California blackworms
- timer

The students will receive the following per table group (4 students) the day of lab:

- 4 plastic cups (1 per alcohol dilution)
- 4 plastic cups (fresh tap water for recovery portion of lab)
- 4 pipettes (1 per alcohol dilution)
- paper towels (in case of spills)
- observation / recovery sheet

Preparation

At least half an hour should be reserved for preparation before lab begins. Each table received 4 plastic cups with the alcohol dilutions along with 4 plastic cups with 40mL fresh tap water. The dilutions included:

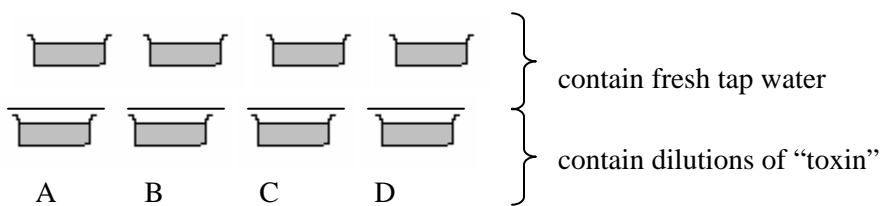
High: this is straight from the original alcohol solution- 40ml as measured by the graduated cylinder

Medium: This is 30 ml water and 10 ml from the original alcohol solution measured by the graduated cylinder. Pour in 30 ml of water and bring up to 40 ml by adding the original alcohol solution

Low: this is 39 ml of water and 1 ml from the original alcohol solution measured by the graduated cylinder. Pour in 39 ml of water and bring up to 40 ml by adding the original alcohol solution using a dropper.

Control: this is ONLY water. Put 40 ml (making sure to not use the same graduated cylinder as you used with the alcohol- or this will be contaminated...) of water in a graduated cylinder. This is used to show how the worms behave normally.

Each plastic cup containing the “toxin” was labeled A (highly concentrated solution), B (moderately high concentrated solution), C (low concentrated solution), and D (control). Students were not told what the water contained or which received the highest amount of “toxin.” The plastic cups were lined up in the center of each table along with the cups that contained fresh tap water behind them (not labeled). The worms were collected in each pipette (1 per pipette) and laid horizontally above each labeled container.



———— = pipettes placed horizontally above cups

The same cups containing the dilutions of “toxin” were used throughout the day. The cups containing the fresh tap water were replaced after each lab as well as the worms. No worms were repeated for more than one lab and were placed in a different tank once they had been used in order to avoid mixing the unexposed worms with the already used worms. Pipettes were cleaned after each class in order to avoid contamination. Same preparation techniques were conducted for each class.

Safety Information

General lab safety / Animal safety

Engagement Technique

I will give the students the following story:

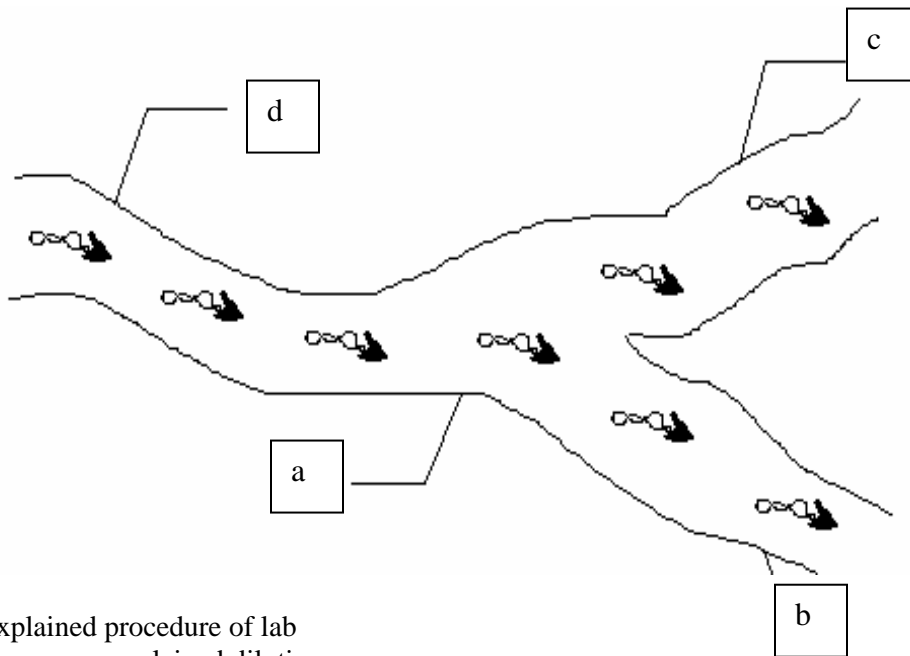
Ask if they have ever heard of canaries being brought into mines with miners. Let them know that the miners brought the canaries in with them because the canaries were more sensitive to changes in the air quality than the miners were, and if the canary started to seem sick or even died, it was a signal to the miners that they needed to get out of the shaft where they were. Lots of different things are used as indicators- and in this scenario; we are using California blackworms as indicators- not of air, but of water quality.

At this point the PowerPoint presentation was presented to the students and the slides are as follows:

- defined terms: toxicology, hazard, toxin
- showed routes of toxin entry
- introduced environmental toxicology research by defining Arsenic, its effects and types of cells used
- explained objective of experiment
- showed where worms were collected

The students are then given the following scenario:

“We have sampled water from a stream along the banks of a river where there is a suspected contamination. Water has been sampled from the points shown along this stream (show picture) and we are going to use the California blackworms to tell us something about the quality of the water from each site. While we might not necessarily want to drink water from a place that can sustain worms, we most definitely do not want to drink from a place that has a negative effect on these worms. What we want to do is take a look at what the natural behavior of the worms and then compare how the worms behave in each of the different samples.” Students were told teacher traveled to California to collect worms from the river during the weekend. Letters correspond to the plastic cups containing the “toxin” and the parts of the river where the worms were collected from.



- explained procedure of lab
- wrap-up – explained dilutions
- showed river picture again and discussed with students if their findings agreed with the picture gave students time to complete KWL sheet

Exploration

At this point give students were ready to begin the lab. The students were assigned roles (one data collector per group). The observation sheet was explained and in order to clarify the activity and recovery ratings a separate poster was made which students were able to refer to while conducting the lab. (0-1 = represented worm with tongue out, 2 = represented worm upside down, looking ill, 3 = represented worm reading a book, 4 = represented worm very active, jumping rope). I then had the students pipette the worms into each of the treatments, asking students to observe what happens and discuss while you continue to place the worms in each treatment.

Students transferred the worms from the provided plastic cups into each of the “toxin” solutions. While allowing the worms to acclimate for 2-3 minutes the students will take notes as to the normal behavior of the worms. They may just observe, or see how the worms react to different perturbations (probing, swirling, etc.)

After 2-3 minutes the students took their first initial observations at 0 minutes, and then again at 3, 6, and 10 minutes. For each time point they took both notes and circled their activity. Activity runs from 0 (no movement), to 2 (normal movement) to 4 (hyperactive).

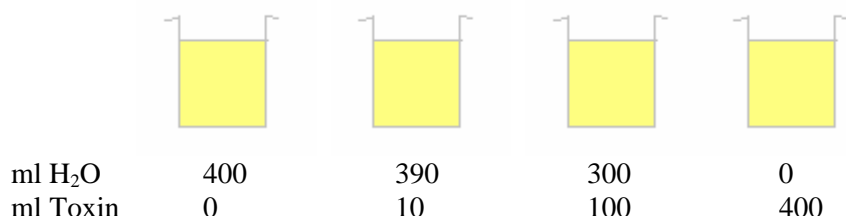
Once the worms were all placed in the treatments, the students were asked to guess which of the treatments might be considered control, low concentration toxin, medium concentration toxin, and high concentration toxin. I asked for a show of hands. We discussed the responses and why it was that each was chosen.

At the end of the experiment, the students transferred the worms to the fresh, uncontaminated water controls for each of the treatments and watched how the worms recovered. The students again observed

the worms in the “recovery” containers and observed whether the worms recuperated and rated their rate of recovery. This was done after 3, 6, and 10 minutes.

Have the students clean up their areas.

When the experiment was completed in order to get an idea of what the students know about dilutions they were given the following picture (included in the PowerPoint). I asked the students which of the four containers they considered the control, low concentration, medium concentration, and high concentration of toxin. It was important that they realized that this is the reason it is easy to compare the concentrations.



Explanation

The students were they shown the second river picture from the PowerPoint slide and were asked if they agreed with the picture and the findings. They were asked why they thought the contamination began there and why the contamination was high and low in some places of the river. The students explained their evidence using the following charts that they used to record their data.

Toxic effects of different water samples on Blackworms: Observations

Group members: _____

Data collector: _____

Directions: Give an activity rating at each time interval (see rating scale below). Place a check mark next to “clumped” or “not clumped” to indicate the behavior of the majority of worms. Record any additional observations under “other.”

Activity Rating:

No Activity	Normal	Some Activity	Very Active	
0	1	2	3	4

Exposure

Swimming Behavior	A	B	C	D
Activity Rating (circle a number)	<u>0 min</u> 0 1 2 3 4	<u>0 min</u> 0 1 2 3 4	<u>0 min</u> 0 1 2 3 4	<u>0 min</u> 0 1 2 3 4

	Notes:	Notes:	Notes:	Notes:
	<u>3 min</u>	<u>3 min</u>	<u>3 min</u>	<u>3 min</u>
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	Notes:	Notes:	Notes:	Notes:
	<u>6 min</u>	<u>6 min</u>	<u>6 min</u>	<u>6 min</u>
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	Notes:	Notes:	Notes:	Notes:
	<u>10 min</u>	<u>10 min</u>	<u>10 min</u>	<u>10 min</u>
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	Notes:	Notes:	Notes:	Notes:

Recovery Observations

Directions: Place the appropriate letter that applies to the majority of the worms at each time period.

Recovery

Swimming Behavior	A		B		C		D	
R = completely recovered	3 min		3 min		3 min		3 min	
P = partially recovered	6 min		6 min		6 min		6 min	
N = not recovered	10 min		10 min		10 min		10 min	
D = dead (mark only after 24 hrs)	24 hrs		24 hrs		24 hrs		24 hrs	

Elaboration, Extension

Wrap-up. The student were asked to complete the KWL sheet – the portion of “What I have learned.” Students were instructed to turn sheets in as well as the observations sheet. Any questions students may have had regarding the lab were answered.

Evaluation

The KWL sheet was used as an evaluation to get an idea of how much the students retained from the lab and if they understood what it was they were to learn from it. The KWL sheet also showed how much the students knew about the vocabulary words prior to the lab.