Baby Genes

Flinn Scientific
FB1575
Alicia Harkins-Mishawaka High School

Student Knowledge

Need to have general knowledge of genetic key words and terms

- P generation, F1 generation and F2 generation
- Alleles- recessive and dominate
- Genotype
- Phenotype
- Punnet square

Materials

- Simulated Male genome
- Simulated Female genome
- Baby Genes Worksheet
- Pencils, colored
- Plastic bags

Procedure

- Each lab team should have 1 male genome and 1 female genome
  - 12 cards in each bag
  - 2 genes on each card represent the allele pair possessed by the individual for one specific trait.

On the Baby Genes Worksheet

- Record the genotype for the male (father)
  - Do this by looking at both sides of the card with the “M” on it
- Record the phenotype for the male
- Record the genotype for the female
  - Do this by looking at both sides of the card with the “F” on it
- Record the phenotype for the female

Teacher Tips

- This kit could be replicated very easily. However, I’m not sure of the copyright issues that may arise from sharing.
- The written student sheets that came with the kit could be enhanced to better engage the students.

BUILDING ECOLOGICAL PYRAMIDS

Submitted by Belinda Dalke - Penn High School - ND RET 2010

Carolina Biological / Inquiries in Science Kit 25-1011 $129.95

This kit is appropriate for high school students (grades 9 -12) and addresses the National and Indiana State Science Education Standards.

PURPOSE: This hands-on inquiry based laboratory activity allows students to explore the flow of energy through ecosystems.

LEARNING GOALS:

- develop the skills necessary to design and perform scientific investigations
- examine the interdependence of organisms using food web diagrams
- learn how energy flows through an ecosystem
- observe the amount of biomass needed at each trophic level
- understand the inefficiencies of energy transfer between trophic levels

TIME REQUIRED: 40 minutes

MATERIALS:

- This kit contains enough material for 30 students working in 15 groups of 2.

INCLUDED IN THE KIT:

- 16 owl pellets
- 32 wooded probes
- 16 plastic forceps
- Owl pellet data sheet
- 16 hand lens
- Owl food chain (poster)
- Bone chart

PROCEDURE:

1. Carefully dissect an owl pellet to determine what the owl has eaten.
2. Using the Bone Chart, identify all the bones found in the pellet.
3. Determine the number of each bone type and reword in the Owl Pellet Data Sheet.
4. Share data with class, use results to calculate amount and mass per year.
5. Create a pyramid of numbers and a pyramid of mass.
6. Calculate the amount of energy transferred from prey to predator.

*supplementary questions and activities are provided.

TEACHER NOTES:

- Use black paper to dissect owl pellet on to allow the bones to stand out.
- Look for a better bone chart.
- Overall a good lab, one in which the students will enjoy.

Submitted by Bryan Smith

LaLumiere School

LaPorte, IN

Adding Inquiry to Units on Photosynthesis and Cell Respiration

When teaching a unit on photosynthesis and cell respiration in a first year high school biology course, students often have difficulty relating the overall chemical process to real organisms. In photosynthesis, green plant cells take in or consume CO_2 to make glucose. When cells need energy, through the process of cell respiration, glucose is broken down to obtain energy and CO_2 is released as a waste product. The color indicator, bromothymol blue, can be used to track CO_2 consumption or release. CO_2 released into a solution produced carbonic acid which turns bromothymol indicator yellow. If the CO_2 is taken out of this same solution, the pH becomes more neutral or basic and the indicator turns blue in color. Using the common aquatic plant, elodea, baker's yeast, and bromothymol blue indicator, students can observe the processes of photosynthesis and cell respiration by following the consumption or release of CO_2. To extend their understanding, students follow up this activity by designing a controlled experiment to test the effects of one condition on cellular respiration of baker's yeast.

Materials

Carolina Biological kit #25-1004 *Energizing Cells*
water bath & thermometer
distilled H_2O
carbonated or sparkling H_2O (But not club soda or tonic H_2O)
test tubes and racks
cork stopper for demo test tube
light fixtures or grow lights
aluminum foil
stop watch or clock w/second hand
0.1M HCL
0.1M NaOH

Procedure

Activity #1 – ***Engage*** the students to think about the processes of cell respiration and photosynthesis with the following demonstrations.

Demonstrate the color indicator bromothymol blue to the students. Take a test tube filled ¾ full of distilled water and add 20 drops of .4% bromothymol blue. Ask students to identify the color. To the same test tube add one drop of 0.1M NaOH and observe the color change to bright blue. To the same test tube add one drop of 0.1M HCL at time until the solution turns yellow. Have students note that blue indicates basic and yellow indicates acid.

Demonstrate that CO_2 dissolved in water produces carbonic acid, thus changing bromothymol indicator yellow. Take a second test tube filled with ¾ full of distilled water, 20 drops of bromothymol blue , and add one drop of 0.1 NaOH to make bright blue. Then add one drop of sparkling or carbonated water at time until the solution turns yellow.

Demonstrate that baking yeast produce CO_2 by cell respiration. Take a third test tube filled ¾ full of tepid warm distilled water. Add pinch of baker's yeast and a pinch of sucrose. Have students observe the bubbles produced. Add one drop of 0.1M NaOH and 20 drops of .4% bromothymol indicator so the solution is bright blue. Put a cork stopper in the test tube and have students observe the color change over time. Leave overnight. By the next day the cork stopper should have blown off the test tube.

Activity #2 – Students will ***explore*** whether the aquatic plant, elodea, utilizes photosynthesis or cell respiration by conducting an experiment under four different conditions. (dark environment in slightly basic bromothymol indicator solution, dark environment in slightly acidic bromothymol indicator solution, light environment in a slightly basic bromothymol indicator solution, & light environment in a slightly acidic bromothymol indicator solution) Students must ***explain*** what should happen under each condition and what they should be able to observe over a period of 2-3 days.

Activity #3 – Students will ***extend*** their understanding of cell respiration by designing and performing a controlled experiment to test the effect of one condition on cellular respiration of baker's yeast. They can use any of the materials used during this lab.

Comments

In regards to materials, the kit includes a very good manual that presents the lab exercise in a learning cycle where students engage, explore, explain, & extend. A live materials card comes with the kit and must be submitted to receive the elodea in time. Most of the materials included can be purchased separately or may already be stocked in a lab (bromothymol blue, yeast, sucrose, forceps, metric ruler, grow lights. 1mL dropping pipettes) Finally, the kit comes with three circular fluorescent light bulbs which will not be necessary if you have grow light in your lab.

The period one ***engage*** activity in this lesson plan is a variation of the one in the manual which presumes students are familiar with color indicators. I think it is necessary to introduce students to the bromothymol blue indicator before proceeding to the ***explore*** stage of the learning cycle.

In regards to the ***explore*** activity, I recommend the following changes from the manual. First, use a minimum amount of weak or dilute base to make two of the solutions blue. The bromothymol blue in the kit is greenish yellow, but adding too much base may hinder results. Also, check the results of this experiment two or three day later rather than the next day. Elodea that has been in light conditions to start may have accumulated enough ATP from the light reaction of photosynthesis and therefore not turn to cell respiration after a 24 hour dark period. Finally, make sure the elodea is fresh and healthy.

Oil Spill Bioremediation Lab

Evaluated by Carrie Bidwell (Clay High School)

Product Information

- **Oil Spill Bioremediation Kit**
- Carolina Supply
- $89.25
- **This lab would be useful in either an Ecology unit or as an introduction to scientific method. I would also utilize this lab as a focal point in a cross-curricular unit with the Social Studies teacher in regards to the Gulf Coast oil spill.**

Materials Provided

- 1 bottle of tetrazolium indicator, 0.02%
  - Chemical indicator that will turn from clear to pink when reduced
- 1 bottle of oil
- 1 container of Rid-X Septic System Treatment
- 1 sheet of labels
- 64 culture tubes with caps
- 81 plastic pipettes

Materials Needed but not provided

- Test tube racks
- At lease 64 mL of distilled water
- 140 mL warm tap water
- Funnel
- 20 x 20 Cheese cloth

Objectives

- Students will learn about the environmental quality of ocean water
- Students will learn about sources of ocean oil pollution and the effects of oil on marine ecosystems
- Students will learn about oil-degrading microbes, how they break down petroleum, and how they can be used in bioremediation of marine oil spills.

Teacher Tips

- The activities in this kit are intended to simulate how oil-degrading microbes can be used to break down petroleum after oceanic oil spills.
- The activities are NOT a direct representation of marine oil spill bioremediation.
- The oil in this kit is a household cooking oil. A microbial suspension will be prepared by mixing Rid-X Septic System Treatment powder and warm tap water and then filtering the mixture through cheesecloth. Rid-X powder contains bacteria, enzymes, micronutrients, and inert ingredients.
- The microbial suspension can be made overnight and does not necessarily needed to be filtered with a cheesecloth as the suspension very clearly separates.

Instructions

- You will be given four culture tubes. You will conduct two controlled experiments in these tubes to test for the breakdown of oil by a suspension of oil-degrading microbes. In Experiment A, oil will be treated with oil-degrading microbes (experimental condition) and without oil-degrading microbes (control condition) in the presence of tetrazolium chemical indicator. A change in the color of the indicator over time signifies chemical breakdown of the oil. Experiment B will be set up in the same manner as Experiment A, but without the chemical indicator. This will allow for observations of visible changes in the composition of the oil over time without visual interference from the colored chemical indicator

Teacher Observations

This lab was a simple, inexpensive, and low maintenance lab. The tetrazolium chemical indicator changed to a very vibrant red color. The test tube with the bacteria and no indicator also displayed positive results. The lab suggests allowing the lab to process 1-3 days, however, better results were obtained when the experiment was allowed to continue 5-7 days.

Investigating Cell Types

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As a biology teacher, I am always on the look out for labs that help demonstrate the differences between plant and animal cells. So in addition to a few other lab kits, I chose to do a lab that centered around cell types. It doesn't hurt to have a bit more microscope practice, either.

The Kit

The kit I ordered was from the Carolina Biological Supply. The kit (Investigating Cell Types) sells for $99.95 and contains enough materials for a class of 30 in groups of two. The kit comes with a coupon for live material that must be sent for. The live material includes a culture of *Paramecium, Euglena* and a large bunch of *Elodea*. The focus of the lab is to distinguish between the structures of plant and animal cells and to build an understanding of why an organism is classified as an animal, or a plant, as well as investigating the effects of environmental conditions on different cell types. Although the kit provides most of the materials needed, teachers will need to supply microscopes, a bit of liquid soap, a 5% salt solution, and a few other supplies deemed necessary by students as they formulate their own experiments.

Background

Paramecium is a group of single-celled eukaryotes, which are commonly studied as a representative of the ciliate group, as they are covered with cilia (small hairs) which allow the cells to move with a synchronous motion (like a caterpillar) at speeds of approximately 12 body lengths per second. There is also a deep oral groove that is used to draw food inside. They generally feed on bacteria and other small cells. Water regulation is carried out by a pair of contractile vacuoles, which actively expel water from the cell absorbed by osmosis from their surroundings. Generally considered a freshwater organism, new species have recently been discovered in the oceans

Euglena is a single-celled photosynthetic protist that can live heterotrophically too. When acting as a heterotroph, the *Euglena* surrounds a particle of food and consumes it through phagocytosis. When acting as an autotroph, the *Euglena* utilizes chloroplasts, to produce sugars by photosynthesis. They move through the movement of a flagella (a long whip-like tail).

Elodea is a genus of aquatic plants often called the waterweeds. *Elodea* is native to North America and is also widely used as aquarium vegetation. The introduction of some species of *Elodea* into waterways in parts of Europe, Australia, Africa, Asia, and New Zealand has created a significant problem and it is now considered a noxious weed in these areas. An older name for this genus is *Anacharis*, which serves as a common name in North America.

Activity 1

In the first activity, students are to study cards of each specimen and compare it to prepared slides of the organisms. They will be asked to draw what they see, looking for the characteristics of each cell type. Although the lab calls for the cards and slides to be presented simultaneously, I think I would withhold the card and have the students draw the organisms without the benefit of the cards at first. Otherwise, I will get drawings that look just like the cards. I would then give the students the cards and have them label the parts they have drawn.

Activity 2

In the second activity, students swill view live specimens of the three organisms. As the Paramecium and Euglena are free-swimming organisms, students will first look at them as they swim naturally and then a drop of protoslo is added to slow down their movement. Specimens are to drawn by students and they are to attempt to identify the organelles that they may see.

Activity 3

In the third activity, students will view the specimens under a variety of environmental conditions. They will submit their organisms to the addition of a soap solution, a salt solution and they will feed the organisms with a dyed yeast solution. Again changes will be noted and if the organism eats, they will try to track the digestion of the yeast. This activity worked very well. We were able to see the yeast being digested by the paramecium.

Activity 4

Although we did not do the fourth activity, this is the portion of the lab that I will enjoy with my students the most. Students are to come up with an experiment of their own to determine some additional differences between the organisms. Hopefully, they would think of other variables to test the organisms with. Some suggestions to help them out could include testing with vinegar, alcohol, light vs. dark, sugar, caffeine, heat vs. cold.

How I will use this lab

This lab will be very beneficial when we are working with cell introduction. Not only will this give the students a hands-on approach but it will help fine tune some of the microscope skills that they will be working on.

AP Biology Lab 10:
Physiology of the Circulatory System

Evaluated by Emily Zablocki (John Adams High School)

Product Information

- AP Biology Lab 10: Physiology of the Circulatory System
- Carolina Biological
- $299.99
- Includes 3 lab activities
  1. Measuring Blood Pressure
  2. Testing Physical Fitness
  3. Heart Rate of Daphnia

- **This lab would be useful in either a Body Systems Unit or Cardiovascular Unit. It could also be a cross-unit to connect with Fitness.**

Objectives

- Use a sphygmomanometer and stethoscope to measure systolic and diastolic blood pressure
- Observe the response of the human circulatory system to various factors and use the results to determine the subject's level of physical features
- Investigate the relationship of temperature and heart rate of an ectotherm

Students will work in groups of 4 and each student will rotate through the roles.
-One member will serve as test subject
-One member will serve as examiner
-One member will serve as data recorder
-One member will serve as timer

Part 1: Measuring Blood Pressure

1. Test subject should be sitting with sleeve rolled up

2. Experimenter should clean earpieces of the stethoscope with an alcohol swab before and after use. Remember: Never leave an inflated cuff on anyone's arm for more than a few seconds

3. Inspect the sphygmomanometer. Be certain the exhaust valve is open and that the cuff is completely deflated.

4. Wrap the cuff snuggly, but not tightly, around the upper arm 2 to 3 cm above the bend of the elbow.

5. Place the bell of the stethoscope directly below the cuff in the bend of the elbow.

6. Close the exhaust valve of the bulb (pump) and rapidly inflate the cuff by squeezing the bulb until the pressure gauge goes past 200 mm Hg.

7. Open the exhaust valve just enough to allow the pressure to drop slowly, by the about 2-5 mm Hg/sec.

8. As the pressure falls, listen with the stethoscope for the first appearance of a clear thumping or tapping sound. The pressure at which you first hear this sound is the systolic pressure. Record the systolic pressure in Table 1.

9. Continue to listen as the pressure falls. The sound will become muffled and then louder. When the sound disappears, note the pressure. Record this measurement in Table 1 as the diastolic pressure.

10. Open the exhaust valve to completely deflate the cuff. Allow the subject to relax for 30 to 60 seconds before proceeding.

11. Repeat steps 1 through 8 two more times, to compete trials 2 and 3. Determine the subject's average systolic and diastolic pressures.

Part 2: Testing Physical Fitness

1. Test 1: Systolic Blood Pressure from Reclining to Standing

   - The subject should recline for five minutes. After five minutes, take the subject's systolic pressure and record it in Table 2.

   - The subject should remain reclining for two minutes after Step 1 and then stand up with arms down at the sides. *Immediately* take the systolic pressure and record the data in Table 2.

   - Determine the change in systolic pressure by subtracting the reclining systolic pressure from the standing systolic pressure. Record this data in Table 2.

   Table 2: **Change in Systolic Pressure From Reclining to Standing**

Reclining Systolic Pressure	
Standing Systolic Pressure	
Change in Systolic Pressure (standing-reclining)	

   Score points for Test 1:

Change (mm Hg)	Points
Rise of 8 or more	3
Rise of 2-7	2
No rise	1
Fall of 2-5	0
Fall of 6 or more	-1

2. Test 2: Standing Pulse Rate

   - The subject should stand at ease for two minutes after completing Test 1. During this time, the subject should avoid moving his or her legs.

   - After two minutes have passed, count the subject's pulse rate for 30 seconds. Multiply the rate by 2 to get beats per minute.

Standing pulse rate= _____beats/minute

Score points for Test 2:

Beats/Min	Points
60-70	3
71-80	3
81-90	2
91-100	1
101-110	1
111-120	0
121-130	0
131-140	-1

3. Test 3: Reclining Pulse Rate

   - The subject should recline for five minutes. (Note: After this test, the subject should remain reclining for the beginning of Test 4.)
   - After five minutes have passed, count the subject's pulse rate for 30 seconds. Multiply the rate by 2 to get beats per minute.

     Reclining pulse rate= _____ beats/minute

     Score points for Test 3:

Beats/min	Points
50-60	3
61-70	3
71-80	2
81-90	1
91-100	0
101-110	-1

4. Test 4: Pulse Rate from Reclining to Standing

   - Have the subject (still reclining from Test 3) stand up.
   - *Immediately* take the subject's pulse. Count the number of beats for 30 seconds, then multiply the rate by 2 to get beats per minute.

Pulse rate immediately upon standing= _____ beats/min

- Now, subtract the reclining pulse rate determined in Test 3 from the pulse rate immediately upon standing to get the pulse rate increase upon standing.

  _____ - _____ = _____

  Pulse upon standing – reclining rate, Test 3 = pulse rate increase

Score points for Test 4:

Reclining Pulse (beats/min)	Points				
	Pulse Rate Increase Upon Standing (# beats)				
	0-10	11-18	19-26	27-34	35-43
50-60	3	3	2	1	0
61-70	3	2	1	0	-1
71-80	3	2	0	-1	-2
81-90	2	1	-1	-2	-3
91-100	1	0	-2	-3	-3
100-110	0	-1	-3	-3	-3

5. Test 5: Step Test

   - Have the subject stand in front of a bench that is 45-50 cm high. On command the subject steps up onto the bench, first with one foot, then the other. The subject then steps down in the same manner. Allow three seconds for each complete up-and-down movement. Repeat five times in rapid succession

   - *Immediately* after the fifth down-step, take the subject's pulse rate for 15 seconds and record it below in the space for "Pulse beats for the 0-to-15 second interval." Repeat at the intervals given below (16-to-30, 31-to-60, and so on) and record the data, then determine the beats/min for the interval counted. Note that the first two intervals are 15 seconds long (multiply by 4 to get beats/min) and the others are 30 seconds long (multiply by 2 to get beats/min). Then, use this data to determine the pulse rate increase for each interval.*

     Pulse beats for the 0-to15 second interval : _____ x 4 = _____ beats/min

     Pulse rate increase = _____

     Pulse beats for the 16-to-30 second interval: _____ x 4 = _____ beats/min

     Pulse rate increase = _____

Pulse beats for the 31-to-60 second interval: _____ x 2 = _____ beats/min

Pulse rate increase = _____

Pulse beats for the 61-to-90 second interval: _____ x 2 = _____ beats/min

Pulse rate increase = _____

Pulse beats for the 91-to-120 second interval: _____ x 2 = _____ beats/min

Pulse rate increase = _____

*Pulse rate increase = beats/min for interval – standing pulse rate (from Test 2)

Score points for Test 5 based on the pulse rate increase:

Standing Pulse Rate (beats/min)	Points				
	Pulse Rate Increase (# beats)				
	0-10	11-20	21-30	31-40	41 +
60-70	3	3	2	1	0
71-80	3	2	1	0	-1
81-90	3	2	1	-1	-2
91-100	2	1	0	-2	-3
101-110	1	0	-1	-3	-3
111-120	1	-1	-2	-3	-3
121-130	0	-2	-3	-3	-3
131-140	0	-3	-3	-3	-3

Now, score points for Test 5 again, this time on the basis of time required for the pulse rate

to return to the level recorded in Test 2:

Seconds	Points
0-30	4
31-60	3
61-90	2
91-120	1
*121+	0/-1

*If 1-10 beats above standing pulse rate, score 0 points.

*If 11-30 beats above standing pulse rate, score -1 point.

Fitness Score: Add your scores for all the tests (remember that there are two score for Test 5) and record your total score here.

Total Score = _____ points

Analysis of Results, Activity B: Testing Physical Fitness

Use your Total Score to identify your relative fitness level:

Total Score	**Relative Fitness**
18-17	Excellent
16-14	Good
13-8	Fair
7 or less	Poor

Part 3: Heart Rate of Daphnia

1. Obtain two concave-depression well slides. Place the slides side-by-side on your workspaces with their concavities facing up.
2. Add a *Daphnia* to the concavity of one slide, in a small volume of culture fluid.
3. Pick up the second depression slide and slip it over. Place this slide, concavity side down, on top of the first slide so that their matching concavities form a shallow pool that holds the *Daphnia*. Use rubber bands to secure the slides together tightly.

4. Place the combined slides in a petri dish. Place the dish on the stage of a stereomicroscope.
5. Observe the Daphnia. Identify and note the position of the organisms' heart, dorsal to the intestine.
6. Use a cup or beaker to obtain a sample of room temperature water. Record the water temperature in Table 3. Slowly pour water into the petri dish until the bottom of the dish is covered. Stop before water covers the top of the upper slide.
7. Working together, one student should count heartbeats while another keeps time. Count the heartbeat for 10 seconds and record the data in Table 3.
8. Discard the water in the petri dish.
9. Obtain a sample of water with a different temperature. Repeats steps 6 through 8 using water with a different temperature each time. Continue until you have tested water from all the water baths or your reach a temperature at which the heart beats too rapidly for you to count.
10. For each water temperature, determine heart rate in beats per minute and record the data in Table 3.

- **Materials Provided**
  - sphygmomanometer
  -stethoscope
  -alcohol swabs
  -timer
  -depression well slides
  - petri dish
  -dropping pipet
  -living *Daphnia magna* (sent separately)

- **Materials Needed but not provided**
  - stereomicroscope
  - cup or beaker
  - 2 rubber bands

Lab Evaluation

This lab is a great lab to use to demonstrate the cardiovascular system. It demonstrates many of the various components of the physiology of the circulatory system. This lab is a great way to provide more inquiry learning as many of the various areas can be expanded upon based on students needs and interests. The physical exercise component can be changed in many ways. For the third portion of the lab, the Daphnia can manipulated in many ways to test how various substances or situations can influence heart rate.

Introduction to Organic Chemistry
An AP Chemistry Lab from Carolina
Heather Lemon (Elkhart Memorial High School)

Introduction: This lab is a very nice microscale organic laboratory, where students determine the identity of known and unknown organic samples (alkanes, alkenes, alcohols, aldehydes, and carboxylic acids) based on their general structures, properties, and reactivity. This lab would make a very good "test" assessment based on what they had learned about organic molecules and oxidation-reduction reactions.

Required Materials:
Carolina Introduction to Organic Chemistry Microchemistry Kit #84-0996
15 mL concentrated sulfuric acid
15 96-Well Microchemistry Plates (disposable, ceramic, or glass)
Glass droppers for each of the samples

Procedure:
Students work in pairs and go through the stations, including the following chemicals to be tested:

- Cyclohexane (alkane)
- Cyclohexene (alkene)
- Ethanol (alcohol)
- Glucose Solution (aldedyde)
- Acetic Acid (carboxylic acid)
- Unknown 1
- Unknown 2

Which should be reacted systematically in different wells with the following chemicals:

- 0.001 M $KMnO_4$
- 1% Bromine Water
- 10% $NaHCO_3$
- 0.1 M $Na_2Cr_2O_7$

Students will collect data on the tested chemicals':

1. Solubility
2. pH
3. Reactivity with provided chemicals

Results:

- **Alkanes** are very stable and therefore not reactive.
- **Alkenes** react with bromine water to form a colorless/light yellow solution. They also react with MnO_4 to form brown MnO_2. In acidic conditions they form an alcohol, which reacts with $Cr_2O_7^{2-}$ to form green Cr^{3+}.
- **Alcohols** react with $Cr_2O_7^{2-}$ to form green Cr^{3+}.
- **Aldehydes** react with MnO_4^- to form brown MnO_2. (Students must wait 2-3 minutes for this reaction to occur!) They also react with $Cr_2O_7^{2-}$ to form green Cr^{3+}.
- **Carboxylic Acids** react with HCO_3^- to form carbonic acid (H_2CO_3), which breaks down into H_2O and CO_2 (g). Students will see the escaping bubbles from the CO_2 (g).
- **All samples have a neutral pH except Carboxylic Acids,** which of course would be acidic (pH <7).

Comments: The Teachers Manual contains some very nice information, but the chemistry explanation is a bit longwinded and disorganized. The student directions, step-by-step solutions in each well overall is solid, but it needs to be more explicit as far as which organic compound goes where, and it needs to make it clear that students should be checking the progress of each well as they go through the procedure.

Also, the unknown #1, acetic acid, has a very characteristic smell, and probably should be changed to another compound.

Plastic well plates are stained and weakened by chemicals used in this lab. I suggest ceramic or glass plates if possible. If not, expect to dispose of well plates used. Also, the 96-well plates are extremely small and some found them difficult to observe changes easily. Larger wells might be more beneficial if they are available.

2010 RET@ND Lesson Plan

"Affecting Plant Responses"
Submitted by John Bogucki, Clay High School

Activity: Side-lighting seedlings

Materials Supplied	**Additional Materials Needed**
2 Circle lights	Aluminum Foil
15 petri dishes	Boxes, each large enough to hold a petri dish
Bag of sand	Water
Bag of barley seeds	Scissors
Teacher's Manual	Small pieces of masking tape
Reproducable Student Guide	Markers

Procedure

Two or three days before the lab - START THE SEEDLINGS

1. Add approximately 40 ml of sand to the bottom of a petri dish.
2. Wet the sand with about 15 ml of water or until the sand is completely wet.
3. Place 10 grains of barley seed on top of the sand. The seeds should be in contact with the sand and water, but should not be submerged.
4. Cover each dish with its lid.
5. Set up and illuminate the two circular lights. Place the dishes under the circular lights.
6. Check the dishes daily. Add water, as necessary, to keep the sand wet.
7. When the seeds germinate, remove the lids.
8. Prepare a cardboard box for each lab group to house their seedlings overnight. Make a 1 cm2 hole on only one side of each box. Each hole should be about 1 inch from the bottom of the box.
9. Write your name or group ID # on the box

The day after you see germination - START THE EXPERIMENT, DAY ONE

1. Use scissors to make three aluminum foil discs, each approx. 1cm in diameter.
2. Fashion each disc into a miniature cap.
3. Fit the foil caps over the tips of three of the seedlings
4. Cut three narrow strips of aluminum foil. Each strip should be a few millimeters less than the height of the seedlings.
5. Roll the strips into hollow tubes
6. Slide these tubes over three of the seedlings to form collars around the seedlings so that a few millimeters of the tip of each seedling will remain visible.
7. The remaining seedlings in the dish will serve as the control group.
8. Write your initials on a small piece of masking tape and place it on the side of your petri dish.
9. Place a small mark on the side of the petri dish, opposite the tape.
10. Place the Petri dish inside the box, beside the hole. Be sure the mark on the side the dish is oriented toward the hole where the light will enter the box.
11. Add water to the sand in the petri dish to keep it sufficiently wet.
12. Close the box and gently place it so that the hole in the box is facing the circle light.
13. Either the light should be lowered or the boxes should be elevated so the circular light is at the same level as the hole in the box.

Check the results, DAY TWO

1. Carefully open your box without jarring its contents.

2. Remove the petri dish and make careful observations of the capped, the collared and the control seedlings.
3. In your lab notebook, describe how each of your groups of seedlings responded to being lit from the side.
4. Auxin is a plant hormone that controls the reaction of a plant to directional light. Can you use the results of your experiment to draw any conclusions about where the light has to hit the seedling to affect the production of the auxin?
5. Based on the results, is auxin concentrated on the lighted side or on the darker side of a seedling?

Understanding Reproduction and Chromosomes

Carolina Biological Supply #25-1007

Submitted by: Julia Kern

Background

This kit is from a series of biological kits called Inquiries in Science. This series of kits uses a learning cycle adapted from Biological Sciences Curriculum Study (BSCS). The lessons are designed around 4 stages of a learning cycle that provide students the opportunity to explore a particular concept, reflect on that experience and then transfer the knowledge gained to a new or similar situation. This particular kit provides exploration by asking students to develop a method of organization for a set of human chromosomes. Students are then asked to reflect on their experience by discussing and comparing the ways in which individual groups organized their chromosomes. Students are then asked to transfer their knowledge of chromosomes and meiosis and combine groups to create a normal human zygote. The final activity takes it one step further by giving students an opportunity to create a zygote with a specific genetic disorder.

Purpose

For students to gain an understanding of asexual and sexual reproduction and review the processes involved in reproduction. Also, students distinguish the processes and results of asexual and sexual reproduction, work with chromosome and karyotype simulations, and understand the causes of common genetic disorders.

Implementation

Engage

Students read a set of prior knowledge questions in order to evaluate prior knowledge. Then a class discussion is held on how different organisms reproduce.

Explore

- In Activity 1, students view prepared slides and living organisms to observe asexual reproduction.
- In Activity 2, students view a human chromosomes spread under the microscope and use magnetic chromosomes representations to simulate a human karyotype.
- In Activity 3, students observe and reproduce normal human karyotypes and discover ways in which genetic information is passed from parent to offspring.
- In Activity 4, students use their prior knowledge to design an inquiry-based experiment to discover how genetic disorders occur.

Explain

A post activity reading section is provided which will develop student's grasp of the concepts of reproduction, chromosomes, karyotyping and genetic disorders.

Extend

A set of follow up questions is provided for students to complete independently as an evaluation of their learning.

- What are advantages of asexual reproduction?
- What is an advantage of sexual reproduction?
- What attributes are used to pair homologous chromosomes?
- Why is it necessary for gametes to be haploid?
- How many chromosomes does a normal human skin cell have? How many chromosomes does a normal human sperm cell have?

Extension

You can also use the chromosome magnets to review the phases of mitosis or meiosis by calling out a phase and asking students to demonstrate it using the magnets and magnet boards.

Paternity Test Lab activity
Ward's Natural Science
36W8551

Evaluator: Kasi Bolden (Washington High School)

Materials Included:

- Agarose
- 5x TBE running buffer
- DNA stain
- Amber bottle
- Gel staining trays
- Biohazard bag
- DNA samples(mother, child 2 alleged
- fathers)

Materials needed but, not provided:

- Agarose electrophoresis chambers
- Power supplies
- Waterbath or microwave
- Micropipets with tips

Objectives:

Learn the process of agarose gel electrophoresis.
Perform the electrophoresis procedure
Identify the most provable DNA match between two alleged fathers

Pre-Lab duties:

1. Introduce some DNA background to student before conducting lab.
2. Melt the agarose gel and pour in the chambers. Do not disturb the gel tray or comb. When the agarose has solidified, it will turn opaque.
3. Store the gel in the refrigerator for up to a week.
4. Prepare the buffer, by reducing its concentration to 5%.
5. Dilute the stain.

Procedure:

1. Remove the comb from the gel by lifting the comb straight up.
2. Add approximately 350mL of TBE running buffer to the chamber or until the liquid went above the gel.
3. Load 10-15µL of each DNA sample into the corresponding lane of your gel.
4. Place the chamber with the wells closer to the negative (black) electrode.
5. Set the power supply between 75-125 volts for approximately 35 minutes.
6. Observe the migration of the loading dye down the gel toward the red electrodes.
7. Carefully remove the gel, on the casting tray, from the electrophoresis chamber.

8. Slide the gel form the casting tray into the staining tray and pour approximately 100 mL of warm dilute stain into the staining tray so that it just covers the gel.
9. Stain gel for 30-60 minutes.
10. Flush the gel.
11. Accurately sketch the bands you see on a blank gel on the analysis section.
12. Determine which of the two alleged fathers is the actual father of the child. Explain how you came to this conclusion.

Assessment:

- Students should illustrate their results.
- Reinforce the subunits of DNA
- Students should be able describe the properties of the bands.
- Students should be able to identify that restriction enzymes cut bands of DNA.

Conclusion:

This lab will solidify the concept of paternity and the importance of using DNA instead fingerprinting. There was a lot of prep time for the teacher. The availability of equipment may be a problem. Students will appreciate the life application of this lab.

RET Molecular Biology Session – 2010
An Evaluation of a Carolina Biological Supply Co. Kit
Module 1: TRANSFORMING *E. coli* with the pGREEN PLASMID from Carolina Biological Supply Co. (AP Biology Lab 6 #211082 ($102.00)/ refill ($21.50))
Module 2: PURIFICATION of the GFP PROTEIN (#211072 ($45.25))
Module 3: ELECTROPHORESIS of the GFP PROTEIN (#211073 ($87.25))
By
Kathleen E. Beason
Elkhart Memorial High School

Purpose of the Lab
- Part 1 - To transform *E. coli* (plasmid contains ampicillin resistance and green fluorescent protein from *Aequorea victoria (a bioluminescent sea jelly))*
- Part 2 - To purify the GFP protein produced by the newly transformed *E. coli*
- Part 3 - To use electrophoresis to verify the presence of the purified GFP protein

Materials Needed (but not included in kit)
Module 1
- Water bath - 42°C
- Ice
- UV light

Background Needed by Students
- An understanding of the characteristics and requirements of bacteria including the effects of antibiotics.
- An understanding of both natural and artificial transformation in bacteria.
- An understanding of genetic engineering including the controversy. Excellent opportunity to discuss/ debate bioethics.
- Techniques: Use of sterile techniques (TREAT ALL BACTERIA AS PATHOGENS), burel pipet, little finger technique, micropipet, and experience loading electrophoresis gels.
- Enough information to make predictions about outcomes.

Procedure
Module 1: TRANSFORMING *E. coli* with the pGREEN PLASMID
- Mark the 2 transformation tubes: + & -
- Add 250 uL $CaCl_2$ (ice cold) to each tube.
- Using a sterile inoculating loop, add E. coli to each tube. MIX WELL!!!
- Using a new inoculating loop, add 1 loop of plasmid to + tube.
- Incubate both tubes on ice for 15 minutes.
- Label media
- Heat shock the cells for 90 sec. Tubes should go directly from ice to heat, and then directly back to ice.
- Using the same burel pipet feed the cells in each tube with 250 uL of Luria broth. (Best to feed - tube first)
- Room/ body temperature 5 - 15 minute recovery period.
- Using a new pipet transfer 100 uL of - cells to each of the - plates.
- Using a new pipet transfer 100 uL of + cells to each of the + plates.
- Spread the bacteria using the glass beads.
- Clean up.

Results
- Plates without ampicillin (#1 & 2) will show a “lawn” of growth: All materials needed for growth are present without poison, so bacteria will grow.
- Ampicillin plate without plasmid (#3): Bacteria is killed - no growth.
- Ampicillin plate with plsamid (#4) will show individual green (transformed) colonies that glow under UV light: Only bacteria that was transformed will grow; therefore, the lesser growth will allow individual colonies to be seen.

Evaluation of Kit

- This lab contains nearly all needed materials.
- This lab showed the expected results with 100% of the RET lab groups
- Normally my classes of high school students get 100% expected results, therefore, it is a relatively easy, inexpensive way to allow students to transform bacteria.

Materials Needed (but not included in kit)
Module 2

- Shaking water bath or shaker (33°C and 37°C)
- +pGREEN plate (from Module 1)
- Micropipets (20, 1000 µL) & pipet tips
- Microcentrifuge
- Beakers with ice
- UV light source

Procedure
Module 2: PURIFICATION of the GFP PROTEIN

- Shake the culture tube to resuspend the *E. coli* cells.
- Use a micropipettor to transfer 1 mL of the overnight *E. coli*/GFP culture into a 1.5-mL tube.
- Cap the tube and place it in a balanced configuration in the microcentrifuge: Spin for one minute.
- Carefully pour off the supernatant into a waste beaker: Do not disturb the green cell pellet.
- Repeat steps 1–4 in the same 1.5-mL tube to pellet cells from a second 1-mL sample on top of the first pellet. This will result in a large, green cell pellet.
- Add 500 µL of lysis buffer to the tube. Resuspend the pellet by pipetting in and out several times.
- Incubate the tube on ice for 15 minutes. Incubation on ice helps prevent protein degradation.
- Place the tube in a balanced configuration in the microcentrifuge: Spin for five minutes to pellet the insoluble cellular debris.
- Transfer 250 µL of green cell extract (supernatant) into a clean 1.5-mL tube. Do not disturb the pellet of cellular debris.

If you are going to perform Part B (PAGE analysis), transfer an additional 100 µL of the cell extract (supernatant) to a second clean tube for later analysis by gel electrophoresis. Label the tube "cell lysate." If you are using the cell lysate in the same lab period, store it on ice or in the refrigerator. If not, store it at –20°C.

- Add 250 µL of binding buffer to the tube containing 250 µL of green cell extract. Close the cap and mix the solutions by rapidly inverting the tube several times.
- Add 400 µL of the cell extract/binding buffer mixture to the tube of hydrophobic bead resin. Close the cap and mix by inverting the tube several times.
- Microcentrifuge for 30 seconds. Gently remove the supernatant with a micropipettor. Do not disturb the hydrophobic bead pellet.
- Add 400 µL of wash buffer to the hydrophobic bead pellet. Mix by inverting the tube several times. This step unbinds weakly interacting cellular proteins from the resin.
- Microcentrifuge for 30 seconds. Gently remove the supernatant with a micropipettor. Do not disturb the hydrophobic bead pellet.
- Elute the recombinant GFP by adding 200 µL of TE buffer to the hydrophobic bead pellet. Mix by inverting the tube several times.
- Microcentrifuge for one minute. **The supernatant now contains the purified GFP**. Use a micropipettor to transfer the supernatant containing the recombinant GFP to a new 1.5-mL Eppendorf tube. Label the tube accordingly. **Note:** If the GFP remains bound to the resin, repeat steps 15 and 16 with another 200 µL of TE and pool this 200 µL with the original 200 µL of TE.
- Observe the purified GFP under ultraviolet light. If you plan on performing the PAGE analysis in Part B, store the purified GFP frozen at –20°C. GFP will retain fluorescence while frozen.

Results

- While the protein showed fluorescence after being grown overnight, and the lysate showed fluorescence after the lysis buffer was added, the final product did not glow, and no line for the GFP

protein appeared in the gel in the next module.

Evaluation of Kit

- I doubt that high school students would be successful with this lab; however, it it beneficial to grow the transformed cells overnight in an incubuator/ shaker, so students can clearly observe the fluorescence produced by the GFP protein.
- Many schools would not have a shaking incubator to grow the bacteria

Materials Needed (but not included in kit)
Module 3

- hot plate, heating block, or water bath capable of maintaining 95°C
- permanent markers
- protein gel electrophoresis apparatus and power supply
- pipets and tips (2–20 µL)
- distilled or deionized water
- beakers with ice
- spatula for separating gel plates
- white light transilluminator (optional)
- instant or digital camera (optional)
- gloves
-

Background Needed by Students

- An understanding of the electrophoresis.
- Techniques: Use of sterile techniques (TREAT ALL BACTERIA AS PATHOGENS), micropipet, and experience loading electrophoresis gels.
- Enough information to make predictions about outcomes.

Procedure
Module 3: Verification of GFP Protein
I. Denature Proteins, Load Gel, and Electrophorese (1 hour, 30 minutes)
Note: There are 10 wells in each gel and each group will load two samples, so each gel will be shared by two or three groups. The protein markers also will be shared.

- Place the 12% polyacrylamide gel into an appropriate gel electrophoresis apparatus and add 1°— tris-glycine-SDS buffer to both chambers. Remove the comb slowly and carefully. Make sure that the sides of the wells are straight.
- Use a permanent marker to label two 1.5-mL tubes: CL = cell lysate (from Part A, Step 9) GFP purified GFP (from Part A, Step 16)
- Transfer 5 µL of cell lysate (CL) and 15 µL of purified GFP (GFP) into the appropriate tubes. These volumes correspond to approximately 10 µg of total protein. Make sure that you have a tube containing protein markers (PM). (You will load 5 µL of the protein marker in Step 6.)
- Add 1.6 µL of 4°— loading dye to tube CL. Add 5 µL of 4°— protein loading dye to tube GFP.
- Heat the samples for two minutes at 95°C to denature the proteins. **Do not heat the marker.** The marker sent with this kit is formulated to be loaded without being heated.
- Refer to Figure 1. Load 5µL of the protein marker into the second well. Load the entire contents of each sample tube into a separate well in the gel. **Use a fresh tip to load each sample.** Load your samples in the following order from left to right: PM (5 µL), CL (group 1), GFP (group 1), CL (group 2), GFP (group 2), CL (group 3), GFP (group 3). Do not use the first and last lanes of the gel, because bands from samples run in these lanes can become distorted.
- Close the tank of the protein gel electrophoresis unit. Connect the

electrical leads to a power supply, anode to anode and cathode to cathode. Electrophorese at 175 volts until the bromophenol blue band has moved to the bottom of the gel. This should take approximately one hour.

- Turn off the power supply, disconnect the leads from the inputs, and remove the top of the electrophoresis box.
- Carefully remove the gel cassette from the electrophoresis chamber. Open the cassette with a spatula and transfer the gel to a staining tray.Wear gloves when you handle the gel. Handle the gel with care to avoid tearing it.

II. Stain the Gel with COOMASSIE® Blue, View, and Photograph (3+ hours)

- Flood the gel with COOMASSIE® blue protein staining solution, **cover the staining tray to prevent evaporation**, and allow the gel to stain from one hour to overnight.
- Wearing gloves, pour off the staining solution. Remove the excess stain by rinsing the gel in tap water.
- Destain the gel in tap water for one to two hours, changing the water every 15 minutes. (The gel may also be destained overnight in a small volume of water.) Protein bands will appear blue. The longer the destaining period, the less intense the background blue stain will appear. Do not destain for too long or the protein bands may lose their intensity.
- View the gel on a white background or on a white light transilluminator. Photograph the gel with an instant or digital camera (optional).

Results

- The unpurified lysate lane should show several bands, and the GFP purified protein should only show one band demonstrating that the protein was purified.
- The lysate lane did show several bands, but the GFP did not show any bands.

Evaluation of Kit

- I liked the idea, but I was not able to purify the protein.
- Since our school does not have chambers for polyacrylamide gels
- I would not buy this kit for my class due to lack of equipment and success with the prcedure.

Behaving Like Animals

A Lab on Behavioral Observation, Inquiry Science and Experimental Design
Carolina Science, Inquiry in Science Series
DH-25-1017
$165.50
Refill: 25-1086 ($89.95)
Ken Andrzejewski, Marian High School

This kit provides materials designed for a class of 30 students working in groups of 5. Each group receives a terrarium with lid, substrate soil, a tropical plant, an LCD thermometer, mealworms, and 3 Anole lizards, also known as American Chameleons (*Anolis carolinensis*), one male and 2 females. In addition, materials not provided in the kit, but needed, include a water spray bottle, twigs, rocks, and an incandescent light source.
Purpose:

This kit is designed to investigate animal behavior, to practice observation, to develop inquiry, and to foster effective experimental design. In addition, the lab allows for the enhancement of stewardship as it requires students to care for living organisms. The laboratory experience is divided into 3 Activities.

Activity 1: Observation

As a group, students discuss and determine the setup of their terrarium. After it is set up, the 3 Anoles are added. At this point, the students will spend 20-30 minutes observing the Anoles' behaviors, and recording/describing them in a notebook. On consecutive days (for at least 5 days) the students should spend 5-10 minutes making and recording additional observations.

Activity 2: Classifying Observed Behaviors

Using an Animal Behavior Chart, students will classify their observed behaviors by type (aggression, communication, feeding, courtship, etc.), description, number of times occurring, and whether the behavior is learned or innate. A set of questions is provided to aid students in their classification of behaviors. In addition, students construct a concept map to compare and contrast innate and learned behaviors.

Activity 3: Modifying the Environment

The culminating activity is the true inquiry task. Students are instructed to create their own experiment in which they alter conditions in the Anoles' environment and observe their behavioral reactions. The experimental design must include a method to represent and analyze the collected data. Before students perform this experiment, they are required to get their new protocol approved by the instructor. An Experimental Design Template is included to help students if necessary.

Assessment of the Kit:

At first, the kit generated a lot of excitement. Once the Anoles were distributed, participants were anxious to watch, feed and water them. A lot of care was involved in finding a warm spot for them over the first weekend. After 2 or 3 days, however, interest faded. Participants continued to feed and water the Anoles, but observations lessened or ceased. I have done similar exercises in the past, using snails instead of Anoles. It is necessary to dedicate a specific time for observations, and a notebooking strategy which will keep the students focused on the activity.
It is important to give students experience in observation skills, experimental design and inquiry. It is also valuable to foster stewardship for living things. This lab provides this experience. With proper monitoring, this lab would be a decent formative activity.

Suggested Modifications:

I am not so sure that Anoles are the best study organism. Problems arise due to the need to feed, water and maintain appropriate temperatures for the lizards. This requires more time than many other potential study organisms due to the nature of reptiles. They would not be able to stay over a break or vacation without care. Additionally, lizard behaviors can be very limited. As I mentioned, I used to do a similar activity using snails. Snails can no longer be shipped into Indiana without special permits, as they easily may become undesirable exotic species if they are released into the environment. I would think that perhaps a

large arthropod (like giant cockroaches or millipedes) may be slightly better as study organisms because they would not require as much care over weekends or breaks.

The kit comes with random tropical plants. Some were very small, others were larger than the terraria and had to be laid on their side. I would recommend using plants of the same species that are all relatively the same size and that fit into the terraria well.

It will be necessary to purchase additional food organisms, as the 300 mealworms that are included will disappear quickly. Also, be sure to have separate incandescent light fixtures set up and ready to go when the terraria are first prepared. Have students collect twigs and rocks from home and bring them in to decorate their habitat.

It is strongly recommended that you avoid this lab if you have an aversion to touching lizards. When the lizards are distributed, place the shipping container in a large box so that escaping Anoles will not get far. Also, be sure to have a student assistant who is not afraid of touching the Anoles.

I would probably use this lab kit once. Then I would modify for future years and use a different study organism.

RET @ Notre Dame
Shelly Gregory – Adams High School
Lab Activity – Simulating Darwinian Theory
Carolina - #251013 $129.95

This kit is designed to help students model Darwin's theory about natural selection. The learning objectives include:

1. Observing how natural selection affects a population
2. Learning how mutations, gene flow, genetic drift, and selective mating may change a population over time
3. Understanding how natural selection tends to create a population more adapted for its environment

Materials included in the kit:

- 6 clear plastic trays
- White sand
- Plastic cups
- Teaspoons, forks, forceps & wooden sticks
- 900 each of blue, yellow & white mini pom-poms
- Paper "environment" sheets
- 2lbs each of blue, green, brown, yellow & red clay
- 16 dice
- Evolution cards
  Environment sheets

Materials Needed:

- Graph paper
- Toothpicks
- Journal

Included in the kit were two different activity ideas, one that could be used as an introductory activity and one that would be more of a reinforcement or enrichment activity.

Summary of Activity #1

- Students are divided into groups of five.
- One student is the timer and the other four are given four different tools and 30 seconds to capture as much prey as possible in three different habitats (sand, water, paper)
  - The prey were different colored pom poms and the tools were spoons, forks, forceps and wooden sticks
- They capture prey for three generations then switch to the next habitat
- Students collect data to determine which predator was best suited for each environment and which prey species was best able to elude capture

Activity #2

1. Students form groups of four and each group create 11 animals from clay
   - Animals should be small and simple
   - Animals will be labeled 2 – 12
   - There should be five animals of one color and 6 of the other
2. Animals are placed on one of the two environment sheets then the dice are rolled to determine which animal is preyed upon (removed from the sheet)
3. If the number rolled matches an animal that is a DIFFERENT color than the environment, it is preyed upon and removed from the environment.
4. A replacement animal is then determined by a roll of the dice (the population must remain at 11). Whatever number is rolled, a copy of that animal is made and placed in the population.

- If it is the number of the animal that was just eaten, roll again to determine its replacement.

NOTE: If the number rolled matches an animal that is the SAME color as the environment it is not preyed upon unless its number is rolled twice in a row.

5. Repeat steps three & four one more time. This constitutes one generation. In each generation there may be zero, one or two animals that may be preyed upon/replaced.
6. After three generations the group will pick an evolution card and create the change as instructed. Then repeat steps 3 & 4 for three more generations. Repeat entire process two more times.

- During the activity a log should be kept of the changes that occurred in the population in each generation. Mutations, color ratios, adaptations etc should all be included.
- When all groups are finished the students will compare their end results with the other groups and discuss how their populations changed.

Evaluation:

Activity 1 is fun but messy. The lab can be easily reproduced without purchasing the kit. I would suggest purchasing the kit to get the teacher/student manual and the initial products then refill the consumables on your own.

Activity 2 is great because each group should have a different outcome. It also helps students to see how different factors can affect natural selection and how that changes the population. However, the directions are long and confusing and need to be rewritten to meet some gaps in how to perform the activity.

RET at Notre Dame
Christine Buckingham
7/7/2010
Lab Kit Presentation #1 “Outbreak: A Study in Epidemiology”

Summary:
-Presentation using “Prezi” as an alternative to Power Point
Thoughts: Prezi seems to be a good alternative to Power Point, but my first impression was that it wasn’t very catching- simple and probably great for making something like a power point when you’re short for time
-Presentation included thoughts and suggestions on introducing what epidemiology is and conjunctivitis

Lab thoughts:
Task: To determine the source of a high school pink eye break out
-25 students from each grade level (these have pink eye from each level) (100 of 400 students therefore, 300 are not infected)

See handout PDF for lab

Suggestions:
Laminate cards
Color-code cards
Provide students with a poster board that allows students to place cards in categories. This can provide a visual and prevent confusion. It will be a bit more prep, but can be used again in the following years and will help with students who are not very strong visual learners
This lab will more than likely go overtime- plan accordingly
I would not recommend this for 9^{th} or 10^{th} graders, perhaps good for 11^{th} and 12^{th} graders when working with recapping scientific method and graphing.
For ~$50 This is not a bad buy if you have the right group to work with- could be a good icebreaker for any sort of science camp, or summer school activity that is not part of a traditional school year program- In forensics for example, this can be useful in helping students think analytically

Investigating Spontaneous Generation

Evaluated by Susan Rathwick, Washington High School, South Bend, IN; ND RET Molecular Workshop, 2010.

Neo Science No. 20-1313 – Fisher Scientific Catalog # S32620 $98.95
Investigating Spontaneous Generation

2 Activities included

Materials Required	Materials Provided
Apron	10 Test tubes
Gloves, heat protective	Plastic pipettes
Compound microscope	Cover slips
Incubator	Loeffler's methylene blue
Test tube tongs	Rubber stoppers
600 mL beaker	Microscope slides
Paper towels	Nutrient broth media
Clothespin	S – shaped glass tube
	Straight glass tube

Objective

- Study Luis Pasteur's classic experiment on spontaneous generation
- Investigate whether spontaneous generation can occur on Earth today.
- Define and recognize the characteristics of "life".

Background

The principle of biogenesis, which states that all living things arise from other living things, is readily accepted today. But, that wasn't always the case. Before the seventeenth century, it was widely believed that living things could arise from non-living things in a process called "spontaneous generation". At the time, this process seemed to explain how maggots appeared on rotting meat or fish or how micro life appeared in a pond that was previously dry. By the mid-1800 a fierce controversy over spontaneous generation ad erupted. The Paris Academy of Science even offered an award to anyone who could provide proof – one way or the other – ad clear up the issue once and for all.

Luis Pasteur, a French scientist, dispelled the theory of spontaneous generation through one of science's most famous experiments. He designed a curve-necked flask. The curved – but open – neck allowed air to enter, but it prevented microorganisms from penetrating the flask. The boiled broth inside the curved – necked flask remained clear for up to one year wit no signs of microbial contamination. But when the curved neck was removed or broken off, the broth became cloudy and contaminated with microorganism within a day. Pasture concluded that the contamination in the broth was due to microorganisms in the air. When they were precluded form entering the flask, it remained "lifeless". Living things could not arise from non-living things. This experiment finally dispelled the theory of spontaneous generation, and it paved the way for the principle of biogenesis to be accepted by everyone.

In this investigation, you will recreate Pasteur's findings by comparing the growth of organisms in tubes that are exposed to particles in the atmosphere with the growth of organisms in tubes exposed to air but not any particulate matter.

Procedure

Step 1 Take a position on the theory of spontaneous generation and develop a hypothesis to tests this investigation.

Step 2 Label one test tube “A” and the other “B”. Pour 25 mL of nutrient broth media in each tube.

Step 3 Place a rubber stopper with the S-shaped curved tubing on Tube B and the rubber stopper with the straight glass tubing on Tube A. Carefully press down on each rubber stopper so that it is securely inserted into the tube.

Step 4 Using the test tube tongs; place both tubes in the boiling water bath. Allow the water to boil for about 20 minutes, or until steam begins to escape from the glass tubing on each test tubes and water vapor starts to collect in the curved end. This water vapor buildup prevents any dust particles in the air from entering the broth in the tube.

Step 5 Turn off the heat and allow the tubes to cool down for several minutes before proceeding to the next step. While wearing heat protective gloves, use test tube tongs to carefully remove the test tubes from the bath, one at a time. Rest both tubes on a test tube rack. Place the rack containing the test tubes in an incubator set at 37˚C. If an incubator is not available, place both tubes in a warm spot in the laboratory.

Step 6 Students should observe the appearance of the broth daily for 6-7 days, and record their daily observations in a data table

Positives

- Could be used as an introduction to the cell theory, microscope use, or study of prokaryotes
- Quick set up, has the ability to be used as a demo or lab activity
- Glass tubes could be bent into S-shapes, requiring only the purchase of the nutrient broth to supply this lab
- Allows students a harmless way of obtaining and growing specimens to view under the microscope

Negatives

- Lab kit was received in poor condition, 5 of the 10 test tubes were broken
- Diameter of glass tubing was much to large to fit into cork openings
- Dangerous set up, possible injury with glass tubing could occurred during the preparation of test tubes

Discussion Questions

1. Why do you think it was important to boil the broth in each tube before proceeding with the experiment?
2. What do you think would have happened to one of Pasterur’s flasks if it tipped over and the broth came in contact with the curve of the neck where the water vapor accumulated?
3. People once believed that fish and other microlife could form from the mud in a pont or lake that sometimes dried up. What type of experiment could be designed to demonstrate that this conclusion is false?

Final Thoughts

A demonstration would probably be the safest option for introducing this idea.
Modifying this strategy could be done by placing both prepared test tubes in an observable location for the students. The students could then hypothesis what they thought would happen to each test tube during the day, a week, or a month. The students could start considering the implications each glass tube opening may have on the content of the nutrient broth.

Keith P. Madden
Ivy Tech Community College
South Bend, IN

Biofuel Experiment Exploring Enzyme-Assisted Cellulose Degradation

This has been a year in which the downside of our near exclusive dependence on petroleum as a portable, liquid fuel has become very apparent. Although other alternative fuels exist for home and business use, ethanol provides the best alternative for use in automobiles. In this lab we explore the use of enzyme cellobiase to produce glucose from the cellulosic source celobiose. Using a cellobiose analog, p-nitrophenyl glucopyranoside as a substrate, we can follow the reaction in which cellobiase cleaves a glycosidic bond to yield glucose. This sugar can then be fermented by microorganisms to ethanol.

Materials supplied

Bio-Rad Biofuel Enzyme kit #166-5035EDU (for 32 students) containing:

Enzyme, cellobiase, 400 µl; Substrate, p-nitrophenyl glucopyranoside, 90 mg; Standard, p-nitrophenol (1 mM, 4 ml); 2x stop solution, 100 ml; 10x resuspension buffer, 50 ml; Extraction buffer, 50 ml; Disposable plastic transfer pipets (DPTPs); 1.5 ml microcentrifuge tubes; 15 ml conical tubes; 1.5 ml standard disposable polystyrene cuvettes; Instruction manual

Required Accessories

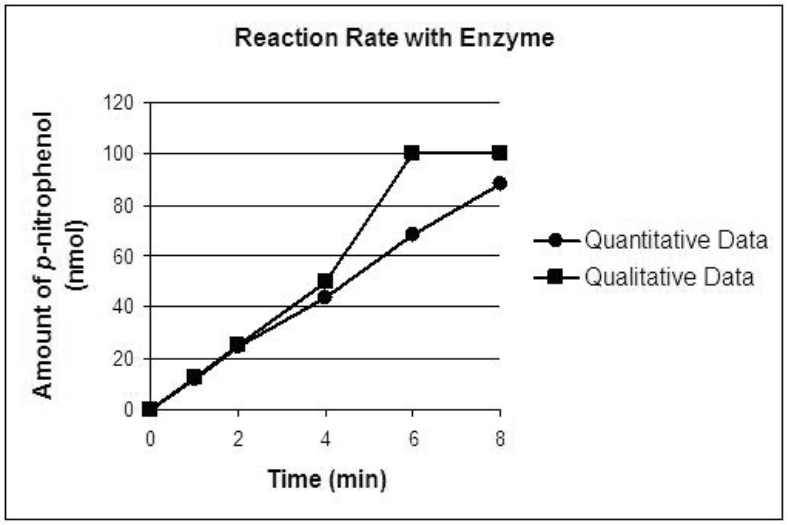
500 ml ml bottle, 200 ml bottle, 3 ea. 100 ml bottle, 150 ml bottle, and 50 ml tubes for preparing reagents and standards; Serological pipettor and pipets or graduated cylinders to measure volumes ranging 4–450 ml; Deionized or distilled water; (optionally) spectrophotometer.

***Engage* the Students:**

Initiate a classroom discussion of the environmental, political, and economic costs of a petroleum-based energy economy. Mention that the easiest route to ethanol, fermenting the starch found in kernels of corn, has an effect on the food supply. Develop the concepts of an enzyme, and discuss the attributes of a protein-based catalyst that would accelerate a biochemical reaction, allowing a reaction to proceed at a much lower temperature in the presence of the enzyme.

E*xplore* – Perform the experiment:

1. Label three 15 ml conical tubes “Stop Solution”, “1.5 mM Substrate”, “Enzyme” and “Buffer”.
2. Label five cuvettes E1–E5, and two cuvettes “Start” and “End”.
3. Pipet 500 µl of stop solution into each labeled cuvette.
4. Label one empty 15 ml conical tube “Enzyme Reaction” and the other “Control”.
5. Pipet 2 ml of 1.5 mM substrate into the 15 ml conical tube labeled “Enzyme Reaction”. Pipet 1 ml of 1.5 mM substrate into the conical tube labeled “Control”.
6. **Time-Sensitive steps here!** Pipet 500 µl of buffer into the 15 ml conical tube labeled “Control” and gently mix. Remove 500 µl of this solution and add it to your cuvette labeled “Start”.
7. Pipet 1 ml of enzyme into the 15 ml conical tube labeled “Enzyme Reaction”. Gently mix, then START YOUR TIMER.
8. At 1, 2, 4, 6, and 8 minutes, remove 500 µl of the solution from the “Enzyme Reaction” tube and add it to the appropriately labeled cuvette containing the stop solution.
9. After all the enzyme samples have been collected, remove 500 µl of the solution from the “Control” reaction tube and add it to the cuvette labeled “End”.
10. Proceed with the analysis of your samples. If a spectrophotometer is available, construct a standard curve of optical absorption as a function of known standard concentration. Use this curve, or direct visual comparison, to determine the concentration of product formed from the substrate as a function of time. Plot this data.
11. Typical data from this kit:



Explain what should happen as the reaction proceeds. Discuss the concept of catalytic active sites, and how the relative concentration of substrate and enzyme can influence the speed of the reaction. Present the possible effects of pH, temperature, and other chemicals in the reaction mixture.
*E**xtend*** the experimental measurements to include pH, temperature, and enzyme / substrate concentrations as independent variables. Using these data as motivation, present the derivation of Michaelis-Menten kinetics to explain the behavior of the system. Introduce the Lineweaver-Burk plot to the students, showing that it is useful for obtaining Vmax, which is a quantitative measure of the speed of an enzymatic reaction
Comments – I was impressed by the quality of the manual in this kit. The directions to students were very clear, with excellent illustration. My colleagues found some confusion between the volume units called out in the text, and those marked on the supplied pipets – this would have to be explained to the students. The preparatory material for the instructor was superb, with derivations of the equations in the optional kinetic modeling activities. The option of using a spectrophotometer increases the precision of the experiments, but the lab will work well using product concentration determination “by eye.”