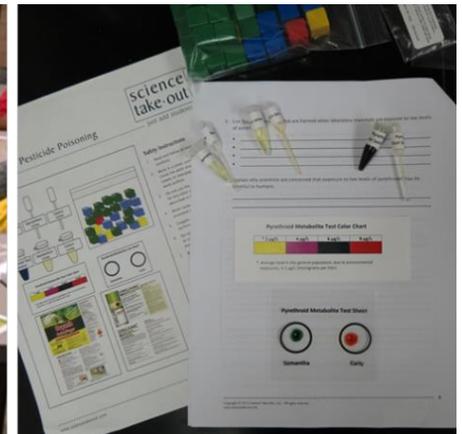


# Science Take-Out Kits for Hands-On Learning

Project funded by a NIEHS Phase I Small Business  
Technology Transfer (STTR) grant

Grant # R41ES023706



## Science Take-Out

UR start-up company that creates, manufactures and sells science kits

- Curriculum expertise

+

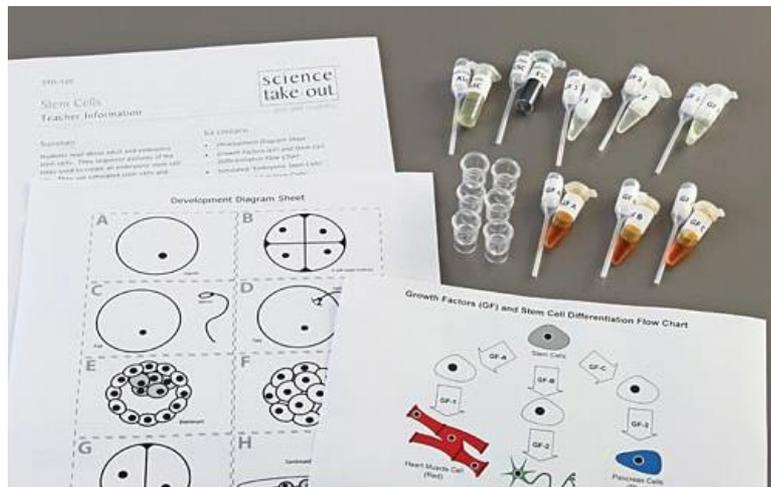
## University of Rochester

Community Outreach and Engagement Core (COEC) of UR Environmental Health Sciences Center

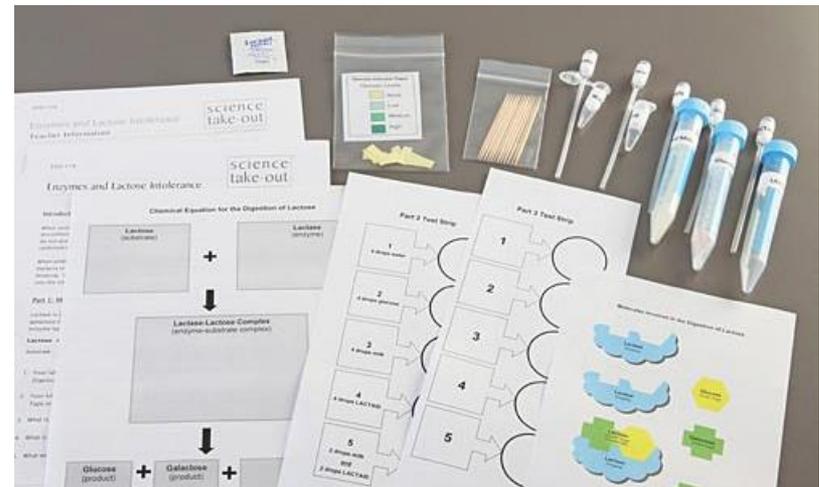
- Environmental health expertise

# Science Take-Out Kits

- Hands-on and minds-on activities with real-life scenarios
- Kit learning objectives align with science education standards
- Each kit contains all the materials needed for the activities
- No teacher prep required and no lab equipment required
- Low cost, individually packaged, and reusable

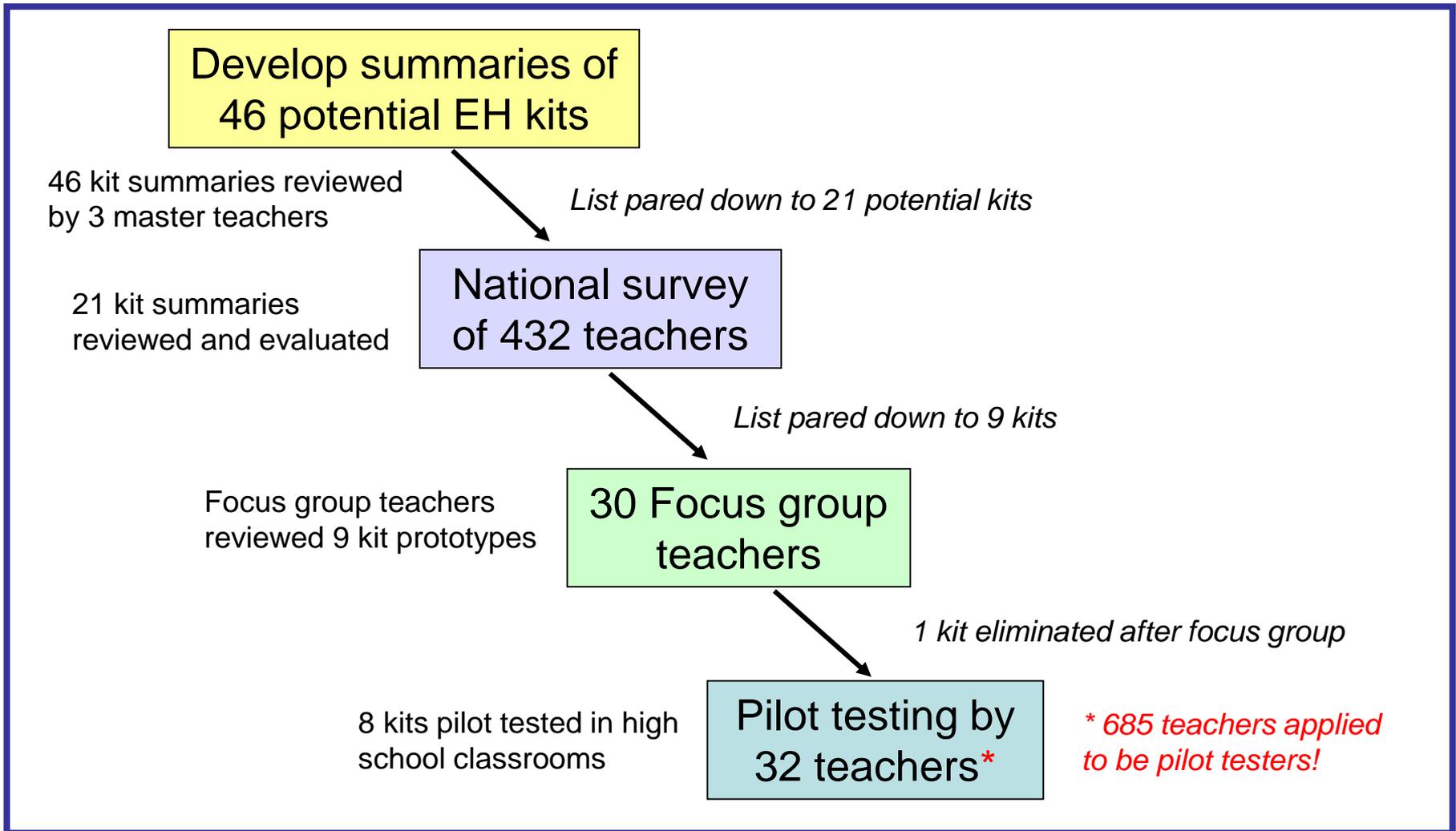


**Stem Cells kit**

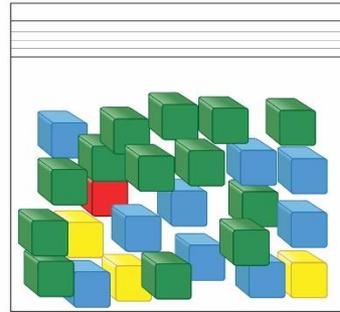
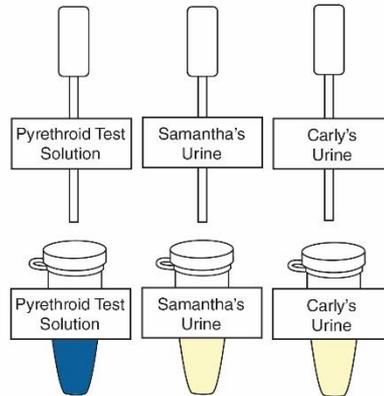


**Enzymes and Lactose Intolerance kit**

# Kit Development Process



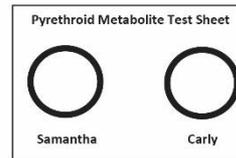
# A Case of Pesticide Poisoning



**Pyrethroid Metabolite Test Color Chart**

* 2 µg/L	4 µg/L	6 µg/L	8 µg/L
Yellow	Purple	Green	Red

\* Average level in the general population, due to environmental exposures, is 2 µg/L (micrograms per liter)



**Organic Bedbug Fogger**

**Directions for Use:**

1. Turn on the fogger.
2. Place the fogger in the room to be treated.
3. Close the door and windows.
4. Leave the room for 15 minutes.
5. Open the door and windows.
6. Turn off the fogger.

**ORGANIC BED BUG SPRAY**

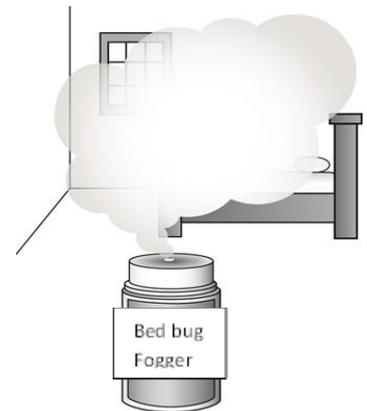
**Directions for Use:**

1. Shake the can well before use.
2. Spray directly on the bed bug.
3. Spray in cracks and crevices.
4. Spray in the folds of the mattress.
5. Spray in the folds of the box spring.
6. Spray in the folds of the sofa.
7. Spray in the folds of the chair.
8. Spray in the folds of the car seat.
9. Spray in the folds of the car floor.
10. Spray in the folds of the car trunk.

## Pesticide Poisoning: Real-life Scenario

Samantha noticed bug bites on her legs. She also found bug bites on her baby Carly's arms and neck. A few days later she discovered spots of blood and tiny dead bed bugs on her bed and in Carly's crib.

She bought bed bug foggers and cans of bed bug spray. That evening, she set up the foggers in her bedroom and Carly's bedroom. She had heard bed bugs are very hard to get rid of so she sprayed all of the sheets and mattresses with the bed bug spray.



The next morning Samantha felt like she was coming down with the flu. Her face tingled and felt numb and warm. She had a cough, stuffy nose, headache, and mild nausea. Carly had the same symptoms and her asthma seemed worse. Samantha also needed to take her dog and cat to the vet because they were vomiting and drooling.



# Interpret the pesticide labels to determine safe use practices



**RESULTS  
GUARANTEED**

## Organic Bedbug Fogger

**Kills on Contact • Effective Long-Term Control**

**Each Can Treats A Room**  
Up to 16' x 16' ft with an 8' ceiling or  
**2,000 sq ft of unobstructed space**

**CONTAINS 3 (20Z) FOGGERS**  
TOTAL NET WT 6 oz (170 g)

NOTICE: To the extent consistent with applicable law, buyer assumes all responsibility for safety and use not in accordance with directions.

**STORAGE AND DISPOSAL**  
Do not contaminate water, food, or feed by storage and disposal.  
**Pesticide Storage:** Store in a cool, dry area. Always store pesticides in the original container. Store away from food and pet food. **Pesticide Disposal and Container Handling:** Do not puncture or incinerate Nonrefillable container. Do not reuse or refill this container. If empty: Place in trash or offer for recycling if available. If **partly filled:** Call your local solid waste agency for disposal instructions.

**PRECAUTIONARY STATEMENTS**  
**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**  
**CAUTION.** Harmful if absorbed through skin. Breathing spray mist may be harmful. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse.

**FIRST AID**  
**IF ON SKIN OR CLOTHING** - Take off contaminated clothing. - Shower immediately with plenty of water for 15-20 minutes. - Call a Poison Control Center or doctor for treatment advice.

**NOTE TO PHYSICIAN:** Contains petroleum distillates — burning may cause aspiration pneumonia.

**PHYSICAL OR CHEMICAL HAZARDS**  
**Contents under pressure.** Do not use or store near heat or open flame. Do not puncture or incinerate container. Exposure to temperatures above 130°F may cause bursting. This product contains a highly flammable ingredient. It may cause a fire or explosion if not used properly. Follow the Directions for Use on this label very carefully.



**Highly Flammable  
Ingredient**

**DIRECTIONS FOR USE**  
It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

**STOP READ ENTIRE LABEL BEFORE EACH USE**

**GENERAL PRECAUTIONS AND RESTRICTIONS:**  
Do not apply this product in a manner that will contact adults, children or pets either directly or through drift.  
• Avoid contamination of food or feedstuffs.  
• For use only when building has been vacated by human beings and pets.  
• Wait two hours after application, then open windows, vents and doors for two hours. If an odor is still detectable, additional ventilation is required.

**To Use This Product Correctly:**  
DO NOT use more than one fogger per room. DO NOT use in small, enclosed spaces such as closets, cabinets or under counters or tables. Use of a fogger in an enclosed space may cause the product to explode, resulting in injury to people or damage to property. Do not use in a room 5' x 5' or smaller; instead, allow fog to enter from other rooms. Turn off all ignition sources such as pilot lights (shut off gas valves), other open flames or running electrical appliances that cycle off and on (i.e., refrigerators, thermostats, etc.). Call your gas utility or management company if you need assistance with your pilot lights.

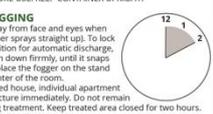
**BEFORE YOU FOG:**  
• In the home, do not apply when food is present. Exposed food should be covered or removed. All food-preparation surfaces and utensils should be covered during treatment or thoroughly washed before use.  
• Close outside doors and windows. Shut off fans, air conditioners and ventilation equipment. Put out all flames, pilot lights and other ignition sources. Contact your utility or management company if you need assistance.  
• Remove pets and birds, cover and turn off fish aquariums before activating fogger.



• Place a chair, small table or stand in the center of the room to be treated and cover with newspaper.  
• Cover wood floors and wood furniture in the immediate area around fogger with newspapers or a drop cloth. Open cabinets, cupboards, drawers, closets and doors in areas to be treated.  
• Use only one canister of fogger to treat a room up to 16 ft x 16 ft with an 8 ft ceiling or 2,000 cubic feet of unobstructed space.  
• For best results, treat all infested areas.  
• Fill out and place hang-tag on the door to the treated area to alert family and others with access to the treated area not to enter for two hours.  
**SHAKE WELL BEFORE USE. KEEP CONTAINER UPRIGHT.**

**TO START FOGGING**  
• Point fogger away from face and eyes when releasing container sprays straight up. To lock valve in open position for automatic discharge, press valve button down firmly, until it snaps into place. Then place the fogger on the stand or table in the center of the room.  
• Vacate the treated house, individual apartment unit or other structure immediately. Do not remain in the area during treatment. Keep treated area closed for two hours.  
DO NOT RE-ENTER FOR TWO HOURS.

**AIRING OUT**  
• Wait two hours after application, then open windows, vents and doors for two hours. If an odor is still detectable, additional ventilation is required.



For more effective control of storage pests, open all cupboard doors and drawers for better penetration of fog. Remove all infested food-stuffs and dispose of in outdoor trash.



## ORGANIC BED BUG SPRAY

- Kills Bed Bugs and their eggs
- For indoor use in the home and non-food areas of restaurants, schools, nursing homes, warehouses, offices, apartments, hotels, motels, kennels, and hospitals
- Will not stain water-safe fabrics and surfaces
- Kills Bed Bugs on wood, ceramic surfaces and carpet for up to 2 weeks
- Reduces Bed Bug egg hatch in both susceptible and some resistant strains of Bed Bug eggs

**DIRECTIONS FOR USE**  
It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

**USE RESTRICTIONS:**  
• Do not apply this product in a manner that will contact workers or other persons either directly or through drift.  
• Only protected handlers may be in the area during application.  
• Remove pets, birds, and cover fish aquariums before spraying, and turn aquarium systems off.  
• Do not allow adults, children, or pets to enter the treated area until sprays have dried. Do not use treated article until spray has dried.  
• Do not use in aircraft cabins.  
• In hospitals and nursing homes, remove patients before treatment. Ventilate room for two hours before returning patients.  
• Do not apply more than 1 time per day.

**THIS PRODUCT IS NOT FOR USE ON HUMANS:**  
Do not use in commercial food/beverage processing, preparation, food/feed storage or serving areas. Remove or cover dishes, utensils, food processing equipment, and food preparation surfaces, or wash them before use. Remove or cover exposed food and drinking water before application.

**SHAKE WELL BEFORE EACH USE.**

**APPLICATION:** Spray in an inconspicuous area to test for possible staining or discoloration. Enclose test area after drying. Hold container upright with nozzle aimed away from you. Depress valve and spray from a distance of 8 to 12 inches. Spray each square foot for 5 seconds or until damp. Do not wet articles to the point of run off or drip. Most effective results are achieved when used as part of a treatment protocol that includes physical, environmental and other chemical pest control measures. Vacate room after treatment and ventilate before reoccupying. Do not allow children or pets to contact treated areas until surfaces are dry. Allow sprayed articles and surfaces to dry thoroughly before using or replacing bedding.

**ACTIVE INGREDIENTS:**  
3-pyretroids-(IRS, 3RS, IRS, 3SR)-2, 2-dimethyl-3-(2-methylprop-1-enyl) cyclopropanecarboxylate.....0.40%  
N-Octyl bicycloheptene dicarboximide.....1.33%  
**OTHER INGREDIENTS**.....98.07%  
100.00%

## ORGANIC BED BUG SPRAY

**TO KILL BED BUGS AND BED BUG EGGS:**  
Apply as a spot treatment to cracks and crevices on and around baseboards, floorboards, bed frames, wall hangings, headboards, furniture, door and window frames, milkwork and walls. Apply as a surface spray to carpet, mattresses, box springs, walls, furniture, bedding, floor and floor coverings, rugs, garments, luggage, clothes, draps and other window appointments. Thoroughly clean and air-out mattresses and box springs. Treat treat areas that harbor Bed Bugs and their eggs, such as tufts, folds and seams. When treating for Bed Bug eggs, spray each square foot for 13 seconds or until damp.

**STORAGE AND DISPOSAL**  
Do not contaminate water, food, or feed by storage and disposal.

**PESTICIDE STORAGE:**  
Store in a cool, dry area. Always store pesticides in the original container. Store away from food and pet food.

**PESTICIDE DISPOSAL AND CONTAINER HANDLING:**  
Do not puncture or incinerate!  
Non-refillable container. Do not reuse or refill this container.  
If empty: Place in trash or offer for recycling if available.  
If **partly filled:** Call your local solid waste agency for disposal instructions.

**PRECAUTIONARY STATEMENTS**  
**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**  
**CAUTION**  
Harmful if absorbed through skin. Avoid contact with eyes, skin or clothing.

**FIRST AID**  
**IF ON SKIN OR CLOTHING:**  
• Take off contaminated clothing.  
• Rinse skin immediately with plenty of water for 15-20 minutes.  
• Call a poison control center or doctor for treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. For information regarding medical emergencies or pesticide incidents, call 1-XXX-XXX-XXXX.

**PERSONAL PROTECTIVE EQUIPMENT (PPE)**  
Applicators and other handlers must wear the following:  
• Long sleeved shirt  
• Long pants  
• Shoes and socks, and  
• Chemical resistant gloves made of any waterproof material.

**USER SAFETY REQUIREMENTS**  
Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product. Do not reuse them.

**USER SAFETY RECOMMENDATIONS**  
User should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

Users should remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Users should remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing.

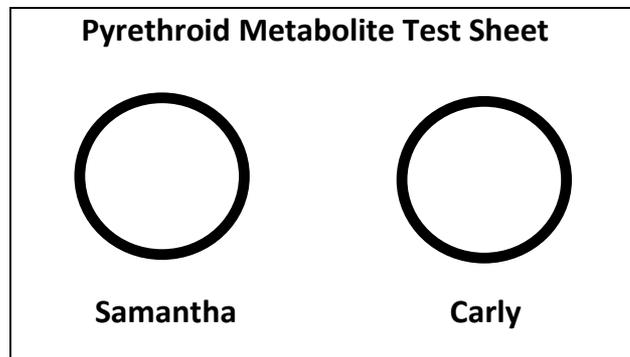
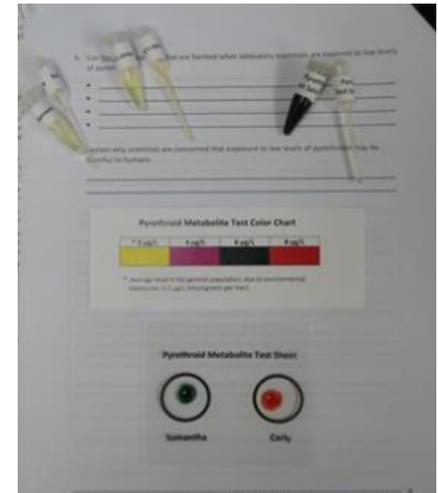
**ENVIRONMENTAL HAZARDS**  
This Product is toxic to fish and aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment, wash water or rinsate. See Directions for Use for additional precautions and requirements.

**PHYSICAL OR CHEMICAL HAZARDS**  
Contents under pressure. Do not use or store near heat or open flame. Do not puncture or incinerate container. Exposure to temperatures above 130°F may cause bursting. Do not apply this product around electrical equipment due to the possibility of shock hazard.

# Simulate Testing for Pyrethroid Metabolites

The emergency room doctor explained that pyrethroids in the pesticide Samantha had used could enter the body by absorption through the skin, by inhalation, or by eating contaminated food. The doctor ordered medical tests to determine the concentration of pesticide metabolites in Samantha's and Carly's urine.

You will test urine samples from Samantha and Carly for the presence of pesticide metabolites. Pesticide metabolites are chemicals produced by the partial breakdown of pesticides.



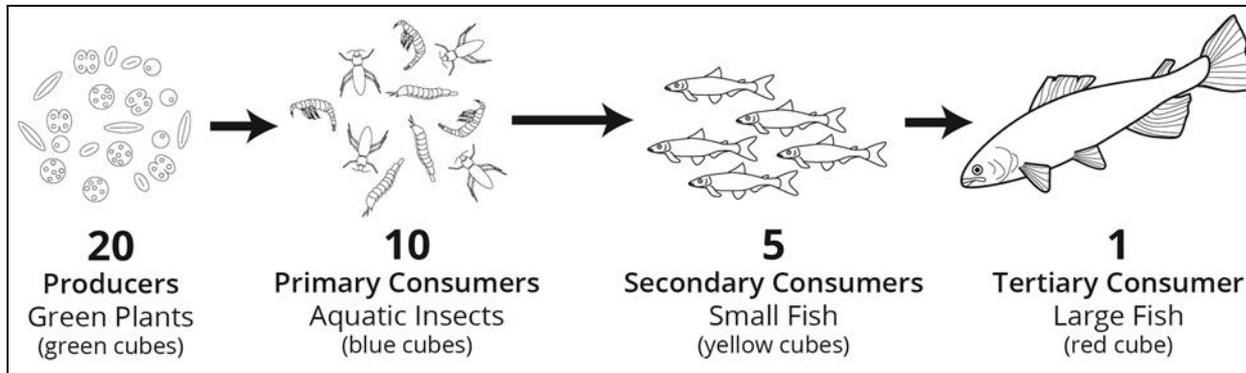
**Pyrethroid Metabolite Test Color Chart**

* 2 µg/L	4 µg/L	6 µg/L	8 µg/L

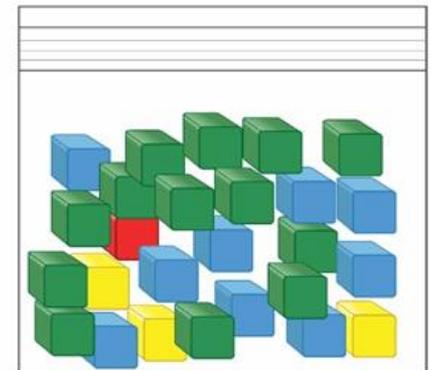
\* Average level in the general population, due to environmental exposures, is 2 µg/L (micrograms per liter)

## How do pyrethroids affect ecosystem biodiversity?

Samantha was very active in a local environmental action group that worked to preserve biodiversity (the variety of plants and animals) in the land and water around her community. She began noticing spray trucks in the farm field near her home and flags on lawns indicating recent pesticide spraying. She wondered if they were spraying pyrethroids. She wondered how pyrethroids affected ecosystem biodiversity.



Use the information the diagram above and the colored cubes in your lab kit. Stack the colored cubes to make a pyramid model of the food chain in the ecosystem.

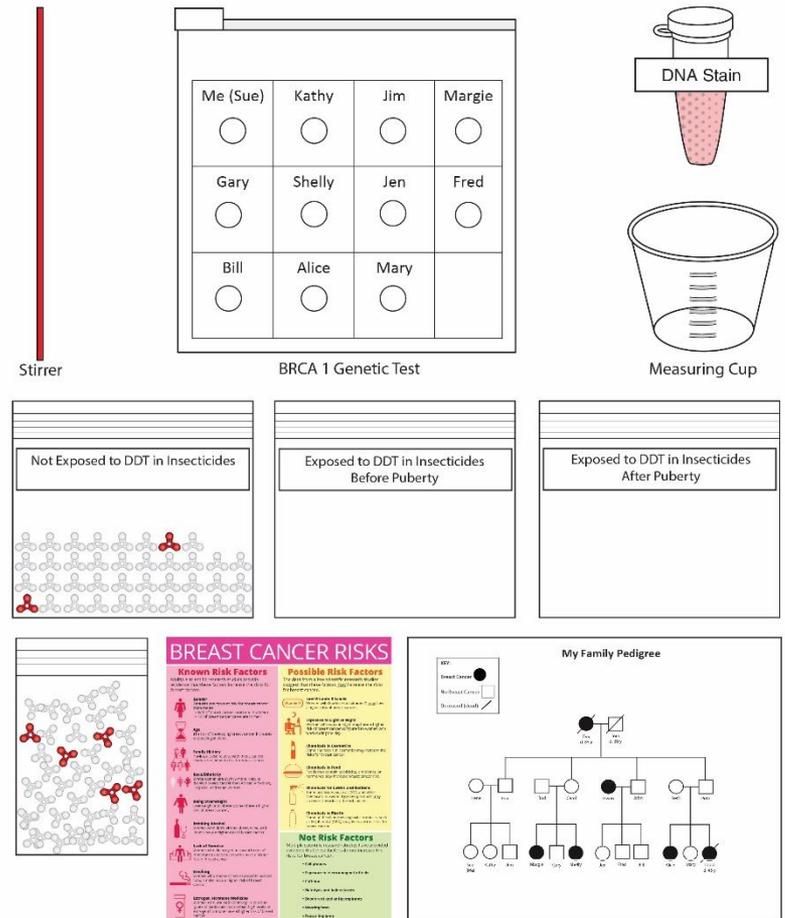


**7 More Kits!**

# Breast Cancer Risk: Genes and the Environment

Explore environmental and genetic risk factors for breast cancer.

- Use results of simulated BRCA1 DNA tests and cancer occurrence to complete a pedigree that includes genotypes and cancer phenotypes.
- Take a survey on risk factors associated with breast cancer and then analyze survey responses based on a *What Science Says* factsheet.
- Analyze data from experiments indicating that environmental exposures before puberty may increase risks of breast cancer.



**Stirrer**

Me (Sue)	Kathy	Jim	Margie
Gary	Shelly	Jen	Fred
Bill	Alice	Mary	

**BRCA 1 Genetic Test**

**DNA Stain**

**Measuring Cup**

**Not Exposed to DDT in Insecticides**

**Exposed to DDT in Insecticides Before Puberty**

**Exposed to DDT in Insecticides After Puberty**

**BREAST CANCER RISKS**

**Known Risk Factors**

- Age
- Family History
- Genetics
- Reproductive History
- Menstrual History
- Diets
- Alcohol
- Smoking
- Obesity
- Chemotherapy
- Radiation

**Possible Risk Factors**

- Environmental
- Work
- Reproductive
- Menstrual
- Diets
- Alcohol
- Smoking
- Obesity
- Chemotherapy
- Radiation

**Not Risk Factors**

- Age
- Family History
- Genetics
- Reproductive History
- Menstrual History
- Diets
- Alcohol
- Smoking
- Obesity
- Chemotherapy
- Radiation

**My Family Pedigree**

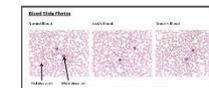
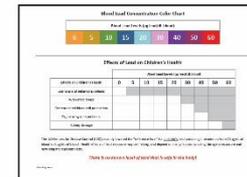
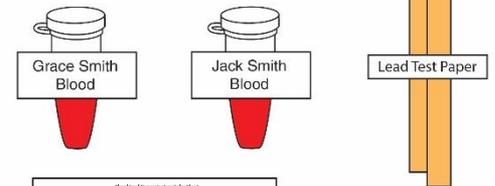
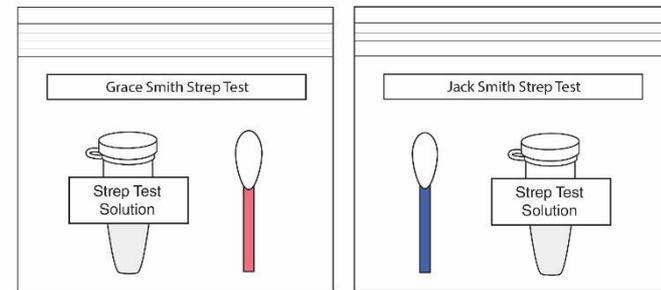
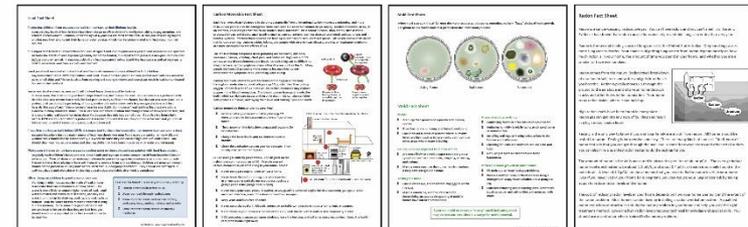
Legend:  
 ● Breast Cancer  
 ○ Not Breast Cancer  
 ■ Deceased Individual

Family Tree:  
 I-1 (Sue) and I-2 (Jim) are parents of II-1 (Sue), II-2 (Kathy), II-3 (Jim), and II-4 (Margie).  
 I-3 (Gary) and I-4 (Shelly) are parents of II-5 (Gary), II-6 (Shelly), II-7 (Jen), and II-8 (Fred).  
 I-5 (Bill) and I-6 (Alice) are parents of II-9 (Bill), II-10 (Alice), and II-11 (Mary).  
 II-1 (Sue) and II-2 (Kathy) are parents of III-1 (Sue), III-2 (Kathy), III-3 (Sue), and III-4 (Kathy).  
 II-3 (Jim) and II-4 (Margie) are parents of III-5 (Jim), III-6 (Margie), III-7 (Jim), and III-8 (Margie).  
 II-5 (Gary) and II-6 (Shelly) are parents of III-9 (Gary), III-10 (Shelly), III-11 (Gary), and III-12 (Shelly).  
 II-7 (Jen) and II-8 (Fred) are parents of III-13 (Jen), III-14 (Fred), III-15 (Jen), and III-16 (Fred).  
 II-9 (Bill) and II-10 (Alice) are parents of III-17 (Bill), III-18 (Alice), III-19 (Bill), and III-20 (Alice).  
 III-1 (Sue) and III-2 (Kathy) are parents of III-21 (Sue), III-22 (Kathy), III-23 (Sue), and III-24 (Kathy).  
 III-3 (Sue) and III-4 (Kathy) are parents of III-25 (Sue), III-26 (Kathy), III-27 (Sue), and III-28 (Kathy).  
 III-5 (Jim) and III-6 (Margie) are parents of III-29 (Jim), III-30 (Margie), III-31 (Jim), and III-32 (Margie).  
 III-7 (Jim) and III-8 (Margie) are parents of III-33 (Jim), III-34 (Margie), III-35 (Jim), and III-36 (Margie).  
 III-9 (Gary) and III-10 (Shelly) are parents of III-37 (Gary), III-38 (Shelly), III-39 (Gary), and III-40 (Shelly).  
 III-11 (Gary) and III-12 (Shelly) are parents of III-41 (Gary), III-42 (Shelly), III-43 (Gary), and III-44 (Shelly).  
 III-13 (Jen) and III-14 (Fred) are parents of III-45 (Jen), III-46 (Fred), III-47 (Jen), and III-48 (Fred).  
 III-15 (Jen) and III-16 (Fred) are parents of III-49 (Jen), III-50 (Fred), III-51 (Jen), and III-52 (Fred).  
 III-17 (Bill) and III-18 (Alice) are parents of III-53 (Bill), III-54 (Alice), III-55 (Bill), and III-56 (Alice).  
 III-19 (Bill) and III-20 (Alice) are parents of III-57 (Bill), III-58 (Alice), III-59 (Bill), and III-60 (Alice).

# An Unhealthy Home

Follow the case of a family suffering from health problems that began when they moved to an older home.

- Perform and analyze simulated strep tests, blood tests, lead tests, and mold tests to determine possible causes for their symptoms.
- Interpret readings and suggest ways that the home environment could be made healthier.

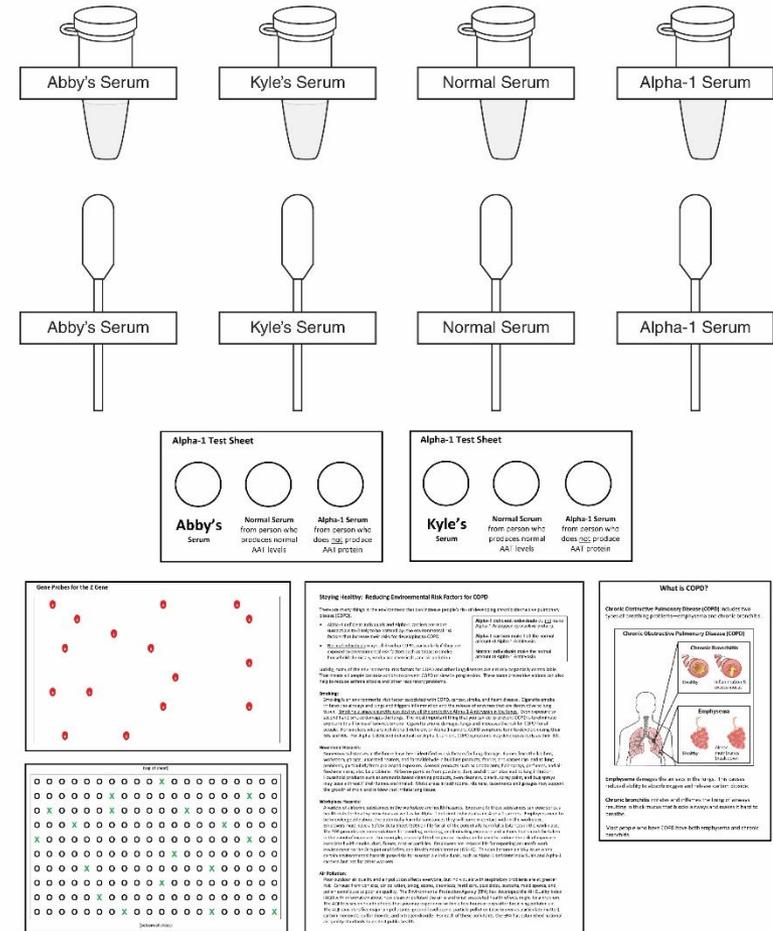



A grid of four informational cards. The top-left card is titled 'Mold' and discusses mold growth and health effects. The top-right card is titled 'Blood Test' and shows a microscopic image of a blood smear. The bottom-left card is titled 'Water Test' and discusses water quality and testing. The bottom-right card is titled 'Water Test' and shows a diagram of a water filtration system.

# Lung Disease: Genes and Your Environment

Follow the case of a mother with COPD (chronic obstructive pulmonary disease) and explore potential environmental contributors to her condition.

- Conduct simulated genetic tests to determine if she and her son have Alpha-1 condition, a genetic predisposition for COPD.
- Model the probability of COPD and the Alpha-1 condition in the US.
- Explore environmental and occupational risk factors for COPD.



The materials include:

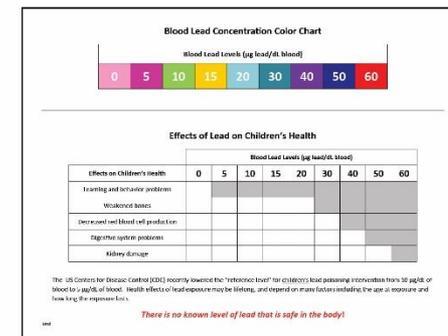
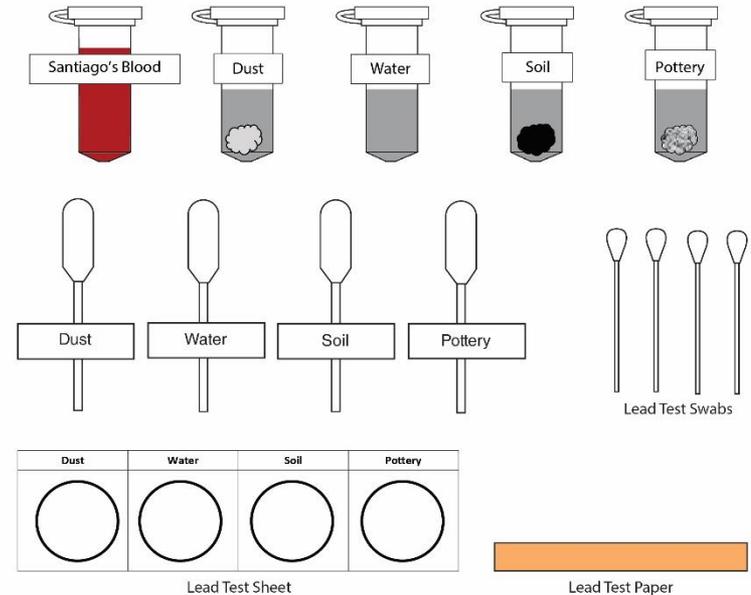
- Serum Test Tubes:** Two rows of four test tubes labeled 'Abby's Serum', 'Kyle's Serum', 'Normal Serum', and 'Alpha-1 Serum'.
- Alpha-1 Test Sheet:** Two sheets showing results for Abby's and Kyle's serum. Each sheet has three circles representing test results.
  - Abby's Serum: All three circles are empty.
  - Kyle's Serum: All three circles are empty.
  - Normal Serum: All three circles are empty.
  - Alpha-1 Serum: All three circles are empty.
- Gene Probes for the Z Gene:** A grid of circles representing DNA probes. Some circles are filled with red or green, indicating specific genetic markers.
- Informational Text:**
  - Staying Healthy: Reducing Environmental Risk Factors for COPD:** Discusses factors like smoking, air pollution, and occupational hazards.
  - What is COPD?:** Defines Chronic Obstructive Pulmonary Disease (COPD) and its components, Emphysema and Chronic Bronchitis.
  - Alpha-1:** Explains the genetic condition Alpha-1 and its link to COPD.



# Lead: An Element of Danger

Follow the case of a young child with lead poisoning.

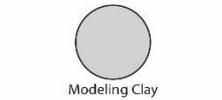
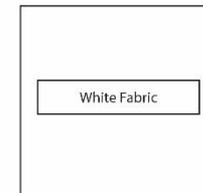
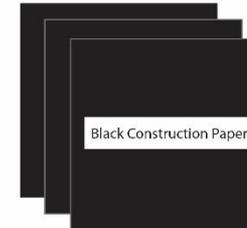
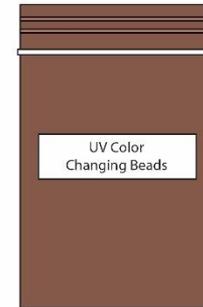
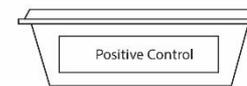
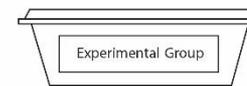
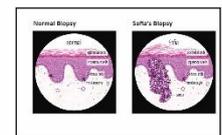
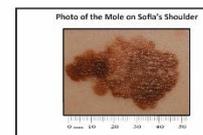
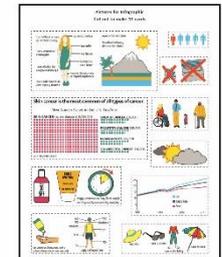
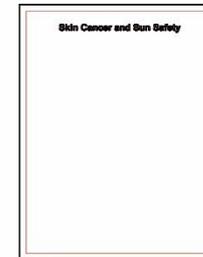
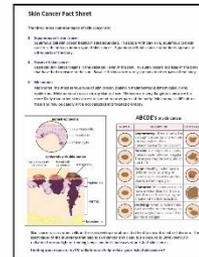
- Conduct simulated blood lead tests.
- Conduct simulated lead tests of dust, water, soil, and pottery.
- Interpret readings and design a plan to reduce lead exposure.



# A Case of Skin Cancer

Follow the case of a young woman who has an unusual mole.

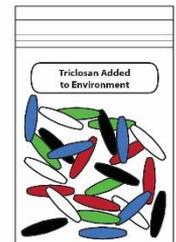
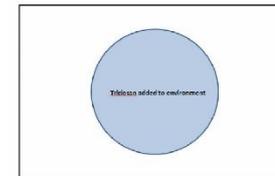
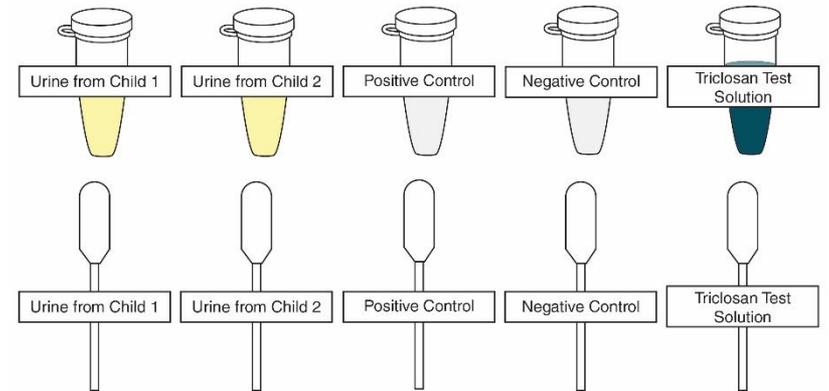
- Use the “ABCDE” characteristics of skin cancer to characterize the mole.
- Analyze a simulated biopsy and determine that the mole is melanoma.
- Use graphic cutouts to create a Skin Cancer and Sun Safety infographic.
- Use materials provided to design and conduct an experiment to test one way to reduce UV light exposure while outdoors.



# Antimicrobials: Is Keeping Clean Risky?

Explore potential environmental health issues associated with Triclosan, an antimicrobial agent found in a variety of consumer products.

- Conduct simulated tests that indicate Triclosan may be present in humans.
- Model how natural selection could result in the evolution of antimicrobial resistant bacteria.
- Analyze readings to identify potential risks and benefits of Triclosan use.



Triclosan Test Sheet	
Sample	1 Drop of Sample + 1 Drop of Triclosan Test Solution
Urine from Child 1 who used antimicrobial products containing Triclosan	<input type="checkbox"/>
Urine from Child 2 who did <b>NOT</b> use antimicrobial products containing Triclosan	<input type="checkbox"/>
Positive Control contains Triclosan	<input type="checkbox"/>
Negative Control does <b>NOT</b> contain Triclosan	<input type="checkbox"/>

Evolution of Antibiotic Resistant Bacteria

Coloring sheet instructions:

- Blue = Sensitive bacteria
- Orange = Resistant bacteria
- Green = Environment
- Red = Antibiotic

Starting with Triclosan sensitive bacteria:

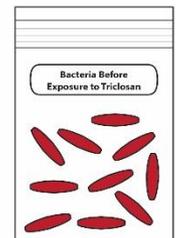
The antibiotic (resistant bacteria survive) kills non-resistant.

Through natural selection, antibiotic-resistant bacteria survive.

Antibiotics are used (antibiotic resistance) and are passed on to the antibiotic-resistant bacteria.

Antibiotic-resistant bacteria survive and reproduce.

Antibiotic-resistant bacteria are passed on to the antibiotic-resistant bacteria.





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## Phase II STTR Grant

- Study the impact of EH kits on student learning.
- Modify the kits for use with diverse community audiences (“community EH kits”).
  - Collaboration with WEACTION (Columbia), UTMB and UNC
- Support teacher-led workshops and community-based workshops.