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

Develop summaries of 46 potential EH kits

46 kit summaries reviewed by 3 master teachers

List pared down to 21 potential kits

National survey of 432 teachers

21 kit summaries reviewed and evaluated

List pared down to 9 kits

30 Focus group teachers

Focus group teachers reviewed 9 kit prototypes

1 kit eliminated after focus group

Pilot testing by 32 teachers*

8 kits pilot tested in high school classrooms

* 685 teachers applied to be pilot testers!
A Case of Pesticide Poisoning
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
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.

<table>
<thead>
<tr>
<th>Pyrethroid Metabolite Test Sheet</th>
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<tbody>
<tr>
<td>Samantha</td>
</tr>
<tr>
<td>Carly</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pyrethroid Metabolite Test Color Chart</th>
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<tbody>
<tr>
<td>* 2 µg/L</td>
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<tr>
<td>Yellow</td>
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* Average level in the general population, due to environmental exposures, is 2 µg/L (micrograms per liter)
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.

How do pyrethroids affect 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.
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.
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.
An infant is admitted to the hospital with serious symptoms. His family recently moved to a house with private well water.

- Simulate testing of water from the family’s well and identify health risks associated with the well water contamination.

- Interpret infographics that provide reasons why most people should drink tap water instead of bottled water.
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.
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.
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.
Kits are available through Science Take-Out

www.sciencetakeout.com
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 WEACT (Columbia), UTMB and UNC
• Support teacher-led workshops and community-based workshops.