

## LESSON:

# Air Pollution Testing: New and Improved!

**Summary:** Students read an article about a new product for testing air pollutants and then design a flyer marketing the product. Students will include advantages and limitations of the new technology. The ultimate goal is to catch the attention of those most likely to purchase this product once it is released, and convince them to purchase it.

**Lesson Type:** Integrated Lesson—This lesson extends beyond traditional science content and can be used in other academic subjects.

**EHP Article:** "More Human, More Humane: A New Approach for Testing Airborne Pollutants" *EHP Student Edition*, June 2007, p. A148–A151  
<http://www.ehponline.org/members/2007/115-3/innovations.html>

**Objectives:** By the end of this lesson, students should be able to

1. discuss the benefits of replacing animal testing with other methods;
2. list specific benefits and drawbacks of using cell cultures to test air pollutant toxicity; and
3. design a flyer marketing a product.

**Class Time:** 45 minutes

**Grade Level:** 9–12

**Subjects Addressed:** Biochemistry, Life Science, Health, Biology, Physiology, Language Arts, General Science

### ► Prepping the Lesson (20 minutes)

#### INSTRUCTIONS:

1. Download the entire June 2007 *EHP Student Edition* at <http://www.ehponline.org/science-ed/2007/junfull.html>, or download just the article "More Human, More Humane: A New Approach for Testing Airborne Pollutants" at <http://www.ehponline.org/members/2007/115-3/innovations.html>.
2. Review the Background Information, Instructions, and Student Instructions.
3. Make copies of the Student Instructions.
4. Develop a rubric for scoring the advertisement if desired (see Step 3 of Assessing the Lesson).

#### MATERIALS (per student):

- 1 copy of the June 2007 *EHP Student Edition*, or 1 copy of "More Human, More Humane: A New Approach for Testing Airborne Pollutants," preferably in color
- 1 copy of the Student Instructions
- 8.5" x 11" white paper
- markers or colored pencils
- background material on advertising theory (optional; see Resources for some online examples)

#### VOCABULARY:

- acute
- assay
- contaminant
- cytotoxicity
- edema
- fibroblasts



- inhibition concentration, 50% (IC<sub>50</sub>)
- *in vitro*
- lethal concentration, 50% (LC<sub>50</sub>)
- local toxicity
- media/medium
- MTS assay
- nanoparticles
- NRU assay
- pollutant
- polyester membranes
- sublethal
- systemic toxicity
- toxicant
- volatile organic compound (VOC)

**BACKGROUND INFORMATION:**

Aside from some of the more technical vocabulary in the article, the content and key points are well covered in the body.

**RESOURCES:**

*Environmental Health Perspectives*, Environews by Topic page, <http://ehp.niehs.nih.gov/>. Choose Chemical Exposures, Innovative Technologies Advertising theory background material:

The Business Research Lab, Advertising research tips, <http://www.busreslab.com/tips/tipsads.htm>

University of South Australia Marketing and Development Unit, Advertising tips, <http://www.unisa.edu.au/mdu/advert/tips.asp>

Humane Society of the United States, Animal testing, [http://www.hsus.org/animals\\_in\\_research/animal\\_testing](http://www.hsus.org/animals_in_research/animal_testing)

Society of Toxicology, Animals in research, <http://www.toxicology.org/ai/air/air.asp>

Wikipedia, IC<sub>50</sub>, <http://en.wikipedia.org/wiki/IC50>

Wikipedia, LD<sub>50</sub>, <http://en.wikipedia.org/wiki/LC50>

## ► Implementing the Lesson

**INSTRUCTIONS:**

1. Hand out the article and the Student Instructions.
2. Have students complete all but the last step of the Student Instructions, working either individually or in small groups of 2 to 3 students.
3. Students should collect materials for creating the advertisement after answering the questions.

**NOTES & HELPFUL HINTS:**

1. Students could create their advertisements as homework.
2. The advertisement described here is meant to be a single-sheet flyer, but students could be given additional guidance to create an advertisement in the form of a script for a radio ad, a script and storyboard for a television ad, or another format of the instructor's choosing.
3. If it is decided to have students complete the advertisement as homework, students should complete Steps 1 and 2 of the Student Instructions individually in class.
4. The advertisement could be scored using a rubric that could be distributed in advance. The class may collaborate on a rubric, or the teacher may construct one in advance of the lesson. Point values for different aspects of the product should be known in advance.



## ► Aligning with Standards

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### **SKILLS USED OR DEVELOPED:**

- Communication (written)
- Comprehension (reading)
- Critical thinking and response
- Technological design

### **SPECIFIC CONTENT ADDRESSED:**

- Cell biology
- Technological innovations
- Animal testing alternatives
- Written communication

### **NATIONAL SCIENCE EDUCATION STANDARDS MET:**

#### **Science Content Standards**

##### **Unifying Concepts and Processes Standard**

- Systems, order, and organization
- Evidence, models, and explanation
- Change, constancy, and measurement

##### **Science as Inquiry Standard**

- Understanding about scientific inquiry

##### **Life Science Standard**

- The cell
- Behavior of organisms

##### **Science and Technology Standard**

- Abilities of technical design
- Understanding about science and technology

##### **Science in Personal and Social Perspectives Standard**

- Personal and community health
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

##### **History and Nature of Science Standard**

- Science as a human endeavor
- Nature of scientific knowledge

## ► Assessing the Lesson

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**Step 2:** a. Describe the technology discussed in the article.

Human cell cultures are being tested for use as animal-free alternatives to testing the effects of exposure to a variety of airborne pollutants. The traditional testing procedure grows cells in a laboratory dish covered with a cell medium. Test contaminants are added to the liquid medium that covers the cells, then researchers measure how the cells are affected by the contaminant. The new procedure grows human cells of different types on a permeable polyester membrane. The liquid medium is removed, and the cells are exposed directly to the airborne pollutant.

b. The scientists who developed the technology hope it will be very useful once further testing is completed. Name at least three advantages this technology has over animal-based testing.

- It is less expensive.
- It reduces the need for animal testing.



- It provides results faster than animal testing.
  - It can test the effects of nanoparticles.
  - It tests a variety of types of human cells.
  - It can test a number of chemicals at the same time.
  - On-site test kits are anticipated to be part of the future of this technology and will significantly help protect human health by allowing testing of actual complex and unique mixtures.
- c. What are two limitations of the technology as discussed in the article?
- It needs additional verification to prove it is comparable to animal-based tests.
  - It needs to be validated, giving reproducible responses for known exposures.
  - It needs to have appropriate control treatments developed.
  - It does not allow whole-system interactions (e.g., immune system or detoxification systems in the body).
  - It has potential interferences from biological agents (e.g., bacteria, mold, or viruses) found in air that may deposit on cells and culture media.

**Step 3:** This new technology is not yet being sold. Your job is to design a flyer (8.5"x11" unless directed otherwise by your teacher) to advertise this new product. Your goal is to catch the attention of those most likely to purchase this product once it is released, and convince them to purchase it.

Responses will vary but should adhere to the guidelines listed later in Step 3 of the Student Instructions. A rubric delineating point values could be developed in advance or by the class so scoring is more straightforward. The rubric could include such specifics as to:

- include at least three pieces of information about how this technology is an improvement.
- include limitations of the technology as "fine print" in the marketing flyer.
- include a "testimonial" quote directly from the article.
- consider color and layout (aesthetic) qualities.

### ► Authors and Reviewers

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**Give us your feedback!** Send comments about this lesson to [ehpscienceed@niehs.nih.gov](mailto:ehpscienceed@niehs.nih.gov).



STUDENT INSTRUCTIONS:  
**Air Pollution Testing:  
New and Improved!**

**Step 1:** Read the article "More Human, More Humane: A New Approach for Testing Airborne Pollutants."

**Step 2:** a. Describe the technology discussed in the article.

b. The scientists who developed the technology hope it will be very useful once further testing is completed. Name at least three advantages this technology has over animal-based testing.

c. What are two limitations of the technology as discussed in the article?



**Step 3:** This new technology is not yet being sold. Your job is to design a flyer (8.5"x11" unless directed otherwise by your teacher) to advertise this new product. Your goal is to catch the attention of those most likely to purchase this product once it is released, and convince them to purchase it.

Some guidelines:

- Decide who will purchase this product.
- Get your buyer's attention.
- Provide a clear message.
- Include the major selling points of the technology.
- Provide evidence of the test's validity and reliability.
- Add graphics and/or pictures, as needed, that relate to the message.
- Use as few words as possible, and choose words carefully.
- Make the flyer aesthetically pleasing.
- Use testimonials from users and developers, as appropriate.
- Address buyer's concerns about any limitations of the technology.

