

## LESSON: Eyes: Windows to the World

**Summary:** Students read and discuss an article on vision disorders related to environmental exposures. Then they use the article as the basis for the creation of a photo collage using both their own photos and images collected from various sources. Integrated Lesson—This lesson extends beyond traditional science content and can be used in other academic subjects.

**EHP Article:** “Focusing on Vision Through an Environmental Lens”  
*EHP Student Edition*, March 2006, p. A822–A827  
<http://ehp.niehs.nih.gov/members/2005/113-12/focus2.html>

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

1. identify environmental factors that affect eye health, both within the United States and abroad;
2. relate eye health to broader measures of economic and social well-being; and
3. demonstrate knowledge of global eye health issues and environmental exposures with a unique and personal creative product utilizing basic photography and collage skills.

**Class Time:** One class period to read the article and assign the project, and one week for students to develop and complete their collages.

**Grade Level:** 10–12

**Subjects Addressed:** Anatomy/Physiology, Biology, Environmental Health, International Studies, Photography, Public Health

### ► Prepping the Lesson (30–60 minutes)

#### INSTRUCTIONS:

1. Download the entire March 2006 *EHP Student Edition* at <http://ehp.niehs.nih.gov/science-ed/>, or download just the article “Focusing on Vision Through an Environmental Lens” at <http://ehp.niehs.nih.gov/members/2005/113-12/focus2.html>.
2. Read the article and the Background Information section of the lesson.
3. Make copies of the Student Instructions and article.
4. Decide whether it will be necessary for students to use school photography equipment, and make arrangements to check out cameras and coordinate with appropriate school staff.
5. Determine whether students will be allowed to utilize free images off the Internet or whether they will be limited to using printed materials.
6. Collect scrap magazines for distribution, if necessary.

#### MATERIALS (per student):

- 1 copy of *EHP Student Edition*, March 2006, or 1 copy of “Focusing on Vision Through an Environmental Lens,” preferably in color
- 1 copy of the Student Instructions
- Access to computers if students will use online photos
- Supplies (as necessary) to create finished photo collages:
  - Photo printer
  - Poster board
  - Collage supplies
  - Glue
  - Scissors
  - Colored markers or pens



**VOCABULARY:**

- Age-related macular degeneration (AMD)
- Amblyopia
- Antioxidants
- Cataract
- Diabetes
- Field of vision
- Free radicals
- Hypercholesterolemia
- Hypertension
- Hypoxia
- Immunization
- Lens
- Measles
- Nystagmus
- Onchocerciasis
- Ophthalmology
- Oxidative damage
- Retinopathy
- Rubella
- Strabismus
- Toxoplasmosis
- Trachoma
- Visual acuity

**BACKGROUND INFORMATION:**

The article “Focusing on Vision Through an Environmental Lens” is an excellent overview of major environmental threats to eye health and vision. Students should gain enough information from the article to identify many vision-endangering practices and substances that can be visually depicted in a photo collage.

Photography is an art form that requires the artist to see things anew. By requiring students to do at least some of their own photography for the assignment, you will be asking them to use their eyes in a new way—to, in essence, see the eye for the first time. Photographing eyes up close without the rest of the face can present some challenges. The key is using enough light. Students should use a digital camera (if possible) with about 4 megapixels of memory. This way, students can experiment with various lighting techniques (without wasting film) and can zoom in while retaining clarity. One way to direct light into the eye to see the color of the iris is to use a large piece of white poster board as a “reflector.” By moving the board around, one will be able to “bounce” light up into the face. Avoid artificial light, especially fluorescent light, which can cast a greenish pall over the subject. Students should also avoid using a flash, especially up close, to protect the subject’s eyes. Students should not have difficulty photographing a wide variety of eye shapes and colors as well as documenting a range of eye health issues associated with environmental exposures such as old age, sun damage, or injury. For images of seriously diseased eyes, students should rely on images available online or from medical texts. Many photos are available online for free noncommercial use from websites such as Google Images.

As the famous landscape photographer Ansel Adams said, “In wisdom gathered over time I have found that every experience is a form of exploration.” Using the information gleaned from the article, students will use their own eyes to explore the environmental impacts on our vision.

**RESOURCES:**

*Environmental Health Perspectives*, Environews by Topic page, <http://ehp.niehs.nih.gov>. Choose Infectious Disease, International Environmental Health American Academy of Ophthalmology, <http://www.aaopt.org/aaopt/>

Gohdes D, Balamurugan A, Larsen B, Maylahn C. 2005. Age-related eye diseases: an emerging challenge for public health professionals. *Preventing Chronic Disease: Public Health Research, Practice, and Policy* 2(3):1–6, [http://www.cdc.gov/pcd/issues/2005/jul/pdf/04\\_0121.pdf](http://www.cdc.gov/pcd/issues/2005/jul/pdf/04_0121.pdf)

National Eye Institute, <http://www.nei.nih.gov/health>

Prevent Blindness America [a nonprofit volunteer organization promoting eye health worldwide], <http://www.preventblindness.org>

World Health Organization, Fact sheet on magnitude and causes of visual impairment [an excellent overview of the international extent of blindness and low vision], <http://www.who.int/mediacentre/factsheets/fs282/en>



## ► Implementing the Lesson

---

### **INSTRUCTIONS:**

1. Hand out the Student Instructions to students and have them read the article “Focusing on Vision Through an Environmental Lens.”
2. Introduce the anatomy of the eye as needed, as well as the concept of a photography-based art project. Read Step 2 of the Student Instructions as a class.
3. Lead a discussion on the article. On the blackboard or a sheet of butcher paper create a list of environmental factors mentioned. Identify factors that are easily shown in a photo and those that may not be (e.g., genetic predisposition). Discuss ideas about how genetic factors may be presented creatively.
4. Decide if you want students to do this project as individuals or in groups. Assign students a specific topic to illustrate in their collage (refer to the table in the Assessing the Lesson section for topic ideas) or have students propose a topic that you approve.
5. Assign a reasonable time frame for the completion of the project outside of class.

### **NOTES & HELPFUL HINTS:**

- You may want to review the anatomy of the eye prior to or during the lesson.
- Disposable cameras are not recommended for this project because most disposables have a depth of field that is too far away to do a closeup of an eye. Usually you have to be about three feet from the subject. If students do not have access to cameras at home, teachers will need to set up a way for students to work together or check out school equipment.
- Students should be encouraged to be creative and should, therefore, not be limited as to the size of the project beyond the guidelines mentioned in Step 2 for the number of photos to be incorporated.
- Students should be advised on how to approach subjects for their photography work. Permission should always be obtained and a full explanation of the use of the image should be offered, even for family members. Photos from the Internet should not be used which are not offered for free educational use or cannot be adequately credited.

## ► Aligning with Standards

---

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

- Classification
- Communication (note taking, oral, written—including summarization)
- Comprehension (listening, reading)
- Observation
- Research

### **SCIENCE CONTENT STANDARDS ADDRESSED:**

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

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

#### **Life Science Standards**

- Interdependence of organisms
- Behavior of organisms

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

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



## ► Assessing the Lesson

Students' work should display a wide variety of interpretations of the theme "Eyes: Windows to the World," but should focus on one condition or a contribution to a condition (see table below). For example, a collage could focus on the generation of free radicals from cigarette smoke and ultraviolet radiation and how those contribute to the formation of cataracts and retinal disorders. Ideally, the collages should reflect a diversity of images including images of eyes belonging to both genders and a range of ages and ethnicities, eyes of various colors and shapes, and perhaps images of people clearly living in poverty, such as those used in the *EHP Student Edition* article. Environmental hazards also need to be visually represented and clearly connected to an eye condition in some way.

Below are some eye conditions and potential environmental causes:

Eye Disorder	Possible Causes of Eye Disorder
Cataract—lens acquires color or becomes opaque	Age, mutations in membrane proteins, injury, diabetes, exposure to ultraviolet light, cigarette smoke (free radicals), diet low in antioxidants (such as vitamins E and C, riboflavin, niacin), systemic inflammation (obesity, older persons), lead exposure, prenatal exposure to rubella, toxoplasmosis
Retinal disorders—damage of the retina	Age-related macular degeneration, smoking (reduced oxygen, depressed levels of antioxidants, altered blood flow), diet low in antioxidants, obesity, high blood pressure, fat and cholesterol intake, genetic link (inflammation or immune response), diabetes (retinal hypoxia), hypertension, hypercholesterolemia
Trachoma—scarring from repeated infection of <i>Chlamydia</i> bacteria.	Infection with bacteria ( <i>Chlamydia trachomatis</i> ) spread by human contact or flies
Onchocerciasis—lesions in the eye tissue from parasite	Parasite ( <i>Onchocerca volvulus</i> ) transmitted to people by black flies. The larvae migrate to the skin and eyes.
Corneal clouding	Vitamin A deficiency

Students should utilize fifteen images, including at least five they take themselves, and identify the sources of all their images (including the ones they produced themselves). Overall the assessment should consider the time put in, neatness of the presentation, thoroughness, and accuracy of information about the conditions including causation and disease manifestation. On their collage, students should be sure to define or adequately describe any conditions or terms they do not understand (e.g., diabetes, free radicals, antioxidants). In their presentation, students need to provide accurate information and provide definitions as well.

## ► Authors and Reviewers

**Authors:** Wendy Stephan and Lisa Pitman, University of Miami Rosenstiel School of Marine and Atmospheric Science, NIEHS Marine and Freshwater Biomedical Sciences Center

**Reviewers:** Susan M. Booker, Erin E. Dooley, Laura Hemminger, Stefani Hines, Liam O'Fallon, Barry Schlegel, Kimberly Thigpen Tart, Heather Valli

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



# Eyes: Windows to the World

"You can't depend on your eyes if your imagination is out of focus." — Mark Twain

**Step 1:** Read the article "Focusing on Vision Through an Environmental Lens."

**Step 2:** Your teacher will either assign you to work in groups or individually. Using the article as a starting point, select one condition (such as onchocerciasis or cataract) or cause of a condition (such as ultraviolet radiation), and then create a photo collage to describe the condition or cause.

Use a minimum of fifteen photos or images on the theme of "Eyes: Windows to the World." Photos and images can be clipped from magazines or downloaded from the Internet—except for at least five, which you must take yourself.

Try to include a range of eye shapes, colors, and creative representations of topics covered in your collage. All photos must be credited fully on the back of the final collage.

Use text as needed to help make connections between the images, eye conditions, and environmental factors, as well as to provide definitions for terminology or conditions (e.g., diabetes, antioxidants). You could include poetry, quotations, and even song lyrics to enhance your collage or make a point.

**Step 3:** Share your work with your classmates and post your work for viewing. Be prepared to accurately answer questions and provide definitions.

