ehp

LESSON:

Beauty or the Beast?

Summary: Students read about a new cosmetics law in California, then examine the ingredients list of a personal cosmetic or toiletry product. Students also evaluate the quality of information sources claiming that certain chemicals in such products are harmful.

Lesson Type: This lesson uses in-depth information from the *EHP* Focus article.

***EHP* Article:** "California Enacts Safe Cosmetics Act"
EHP Student Edition, October 2006, p. A402
http://www.ehponline.org/docs/2006/114-7/forum.html

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

1. evaluate the labeling and ingredients list of cosmetic and toiletry products; and
2. identify sources of unbiased and reliable information.

Class Time: 45–50 minutes

Grade Level: 9–12

Subjects Addressed: General Science, Health, Biology, Environmental Science

Prepping the Lesson (15 minutes)

INSTRUCTIONS:

1. Download the entire October 2006 *EHP Student Edition* at http://www.ehponline.org/science-ed/, or download just the article "California Enacts Safe Cosmetics Act" at http://www.ehponline.org/docs/2006/114-7/forum.html.
2. Review the Background Information, Instructions, and Student Instructions.
3. Make copies of the Student Instructions.
4. Decide if you want to have the students bring their own personal cosmetic or toiletry products to class to evaluate or whether you want to supply the products. It may be more meaningful if the students bring their own products and you have a few extra on hand for students who forget to bring a product to class.
5. A day or two before implementing the lesson, have a brief discussion with the students and ask them to identify or list types of cosmetic and toiletry products. Write the list on the board as students provide examples. These include shampoo/conditioner, shaving cream, lotion, hair styling products, perfume, makeup, nail polish and remover, toothpaste, mouthwash, eye drops, contact lens cleaner, bubble bath, tooth whitener, acne products, etc. Ask each student to bring 1 (or more) cosmetic product(s) to class.

MATERIALS (per student):

- 1 copy of the *EHP Student Edition* October 2006, or 1 copy of "California Enacts Safe Cosmetics Act"
- 1 copy of the Student Instructions
- 1 personal cosmetic or toiletry product

VOCABULARY:

- carcinogen
- reproductive toxicant
- teratogen

BACKGROUND INFORMATION:

The lesson provides most of the information needed to conduct the lesson; however, some additional information on phthalates and chemical mixtures is included for your reference for discussions you may have with students. More detailed information can be found in the Resources section, as well as in related lessons.

Phthalates are plasticizers used in many cosmetic products to dissolve ingredients, moisturize skin, and provide flexibility (as in

nail polish). Phthalates are in a class of chemicals called estrogen mimics. Estrogen mimics have been linked to health effects such as decreased sperm counts, boys' testicles not descending, and cancers of the breast, testis, and prostate.

Exposure to mixtures of toxic chemicals also appears to be a growing problem. Since the year 2000, the Environmental Working Group (EWG) has conducted a series of studies on the presence of chemical mixtures in infants and adults, and has found 455 toxic chemicals out of 535 tested in blood, urine, and breast milk. On average, study participants had in their bodies 53 carcinogens, 58 endocrine disruptors, 53 immunotoxic chemicals, and 55 chemicals linked to birth defects or abnormal development.

The big unknown is the health repercussions of these toxic mixtures. There are three types of potential effects of toxic chemical mixtures: synergistic, additive, or antagonistic. When a mixture of chemicals multiplies or increases a health effect beyond what would be expected from the individual chemicals, then the effect is said to be synergistic. If a mixture of chemicals produces an effect in line with expectations, it is called additive. Occasionally chemicals can interfere with each other and produce a weaker-than-expected health response, which is called antagonistic.

Unfortunately, a number of the environmental mixtures we are exposed to appear to have either additive or synergistic effects. One combination of chemicals particularly relevant to cosmetics is estrogen mimics. Research shows that even when certain estrogen mimics are present at concentrations that produce no adverse effects on their own, the low-dose combination produces toxic health effects. For example, several studies show that breast cancer cells multiply more quickly in mixtures of estrogen mimics than in exposures to the individual chemicals alone (e.g., Payne et al. 2001).

Reference:

Payne J, Scholze M, Kortenkamp A. 2001. Mixtures of four organochlorines enhance human breast cancer cell proliferation. Environ Health Perspect 109:390–397, http://www.ehponline.org/members/2001/109p391-397payne/payne-full.html

RESOURCES:

Environmental Health Perspectives, Environews by Topic page, http://ehp.niehs.nih.gov. Choose Endocrine Disruptors, Phthalates, Women's Health

Campaign for Safe Cosmetics, http://www.safecosmetics.org/

EHP Student Edition, "A Whiff of Danger" lesson, April 2005, http://www.ehponline.org/science-ed/lessons.html

Environmental Working Group, Body Burden study, http://www.ewg.org/bodyburden/results.php

U.S. Department of Agriculture, The National Organic Program, http://www.ams.usda.gov/nop/indexNet.htm

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Cosmetics, http://www.cfsan.fda.gov/~dms/cos-toc.html

Weinhold B. 2003. Body of evidence. Environ Health Perspect 111:A394–A399, http://www.ehponline.org/members/2003/111-7/focus.html

Implementing the Lesson

INSTRUCTIONS:

1. Instruct the students to read the article. This can be done as a group reading aloud or individually. Have the students highlight key or important points of the article and discuss as a group. Some points you may want to discuss include:
   - California's justification for the Safe Cosmetics Act—The FDA does not have strict enough regulations for the cosmetic industry; the public has a right to know what is in products they use.
   - Why/how California's decision to implement the Safe Cosmetics Act will impact people residing in other states—If companies have to make a different formulation for California, in order to save money they will make the same formulation for the rest of the United States. This is a potential benefit to all consumers.
   - Types of health concerns discussed in the article (carcinogens, teratogens, reproductive toxicants)—You may want to mention that chemicals can also be toxic to the liver, kidneys, and lungs.
   - Even though these products are put on the outside of our bodies—they still get inside (via absorption through the skin and inhalation when breathing), where they can accumulate. One study showed phthalate metabolites increased by 33% for each phthalate-containing product used. So if you are using shampoo, conditioner, lotion, and hair spray, each of which contains phthalates, your "body burden" will be much higher that someone who uses only shampoo and lotion. (Refer to the Background Information section for more information about phthlates and chemical mixtures.)
   - Lack of protection by the U.S. Food and Drug Administration (FDA)—Ingredients that have been deemed unsafe can still be used in products. Other weaknesses of the FDA regulations are discussed in Step 2.
   - Others' standards—Europe already has stricter, more health- protective standards than the United States.

2. As a class, read and discuss the information about the FDA in Step 2. Some questions you may want ask students are:
   - What are some possible concerns if regulation happens *after* a product is released?
     - Manufacturers can use a chemical, whether or not it has been tested for safety.
     - Humans essentially become a living laboratory.
   - Ask the students to hold up any products that are labeled "natural" or "all natural."
     - How are those words intended to make us feel?
       - That somehow the product is safer.
     - What are some problems with this language?
       - It does not guarantee safety. For example, poison ivy is natural, but would you want to put it on your face? Petroleum jelly, or petrolatum, is also natural (it is made from petroleum oil) but may be linked to cancer.
       - Many products labeled as "natural" may also contain man-made chemicals.
   - Ask the students to hold up products that are labeled "hypoallergenic," "dermatologist tested," "non-irritating," "alcohol free," or "fragrance free."
     - When we see a statement made on a label, what do we expect or assume about that product?
       - That the product has been tested as advertised, and that the statement is true.
     - This is where enforced regulations come into play. For example, if a product is labeled "organic," it means very specific things (e.g., the product was grown without pesticides, antibiotics, hormones, or certain fertilizers), and the claim has been certified as being true by the U.S. Department of Agriculture through an independent inspector. If the statement is found to be untrue, manufacturers are fined up to $10,000 per violation. There are no such enforcements for cosmetics labeling.
3. Instruct the students to complete Steps 4–6 on their own. Discuss as needed. Use the Assessing the Lesson section for points of discussion. You may also consider asking the following questions:
   - What if the EWG list is wrong or biased? (Refer to the Notes & Helpful Hints section for the webpage with the list of harmful chemicals found in cosmetics.)
     - Removing suspect ingredients may negatively impact the shelf life of the product.
     - The product may not work as well once the potentially hazardous ingredients are removed.
     - The profits of the companies may be negatively impacted.
   - What if the EWG list is correct?
     - People's health may be negatively affected.
     - Dangerous products pass into the environment as we take showers, then seep into the food and water we eat and drink.
   - Which is the greater societal risk—loss of company profit or harm to public health?
   - Would you pay more for a product that you know works AND does not hurt your health?
   - Is there a way to balance profit and health?
     - You may want to discuss some of the companies that have pledged to not use known or suspected carcinogens or reproductive or developmental toxicants; see http://www.ewg.org/reports/skindeep2/findings/index.php?content=compact_signers#begin.

NOTES & HELPFUL HINTS:

- Go to the website "Skin Deep" sponsored by the EWG, http://www.ewg.org/reports/skindeep2/, and have the students look up their product(s) to find out the specific chemicals of concern in the product. Chemicals and products are rated as being of low, moderate, or higher concern.
- This activity could be expanded to incorporate data collection. Students could list the number of cosmetic products they use on a daily or nearly daily basis and mark the ones on the list that contain toxic chemicals. The lists could be combined across classes, and the students could calculate the percentage of products that contain toxic chemicals from the list.

Aligning with Standards

SKILLS USED OR DEVELOPED:
- Classification
- Communication (note-taking, oral, written—including summarization)
- Comprehension (listening, reading)
- Critical thinking and response
- Observation

SPECIFIC CONTENT ADDRESSED:
- Label reading
- Laws/regulations
- Environmental health
- Cosmetics
- Evaluating sources of information

NATIONAL SCIENCE EDUCATION STANDARDS MET:

Science Content Standards

Unifying Concepts and Processes Standard
- Systems, order, and organization
- Evidence, models, and explanation

Physical Science Standard
- Chemical reactions

Science as Inquiry Standard
- Understanding about scientific inquiry

Science in Personal and Social Perspectives Standard
- Personal and community health
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

Assessing the Lesson

Step 4: Students assess their labels and circle the chemicals present in their product. Answers will vary.

Step 5: Based on the information you have read and collected about your product, do you think a national law similar to the California Safe Cosmetics Act and laws already in place in Europe is needed? Why or why not? Justify your answer with at least two logical points or arguments.

Students should write a clear, concise statement that lists at least two points/arguments supporting their answer.

Step 6: Read the following and answer the question [additional information is included on the Student Instructions].

a. Would these sources be considered reliable, unreliable, biased, or unbiased? Why or why not? Include logical points or arguments to support your answer.

Answers will vary, but generally sources used by the EWG are reliable and unbiased because they receive independent funding to conduct their research (i.e., the funding is not from cosmetic companies who have a financial stake in the outcome). Also, these sources have compiled and reviewed hundreds of studies on a single chemical upon which to base their decisions about the toxicity of that chemical (rather than just one or two isolated studies). Bias may enter into the EWG rating system (low, moderate, high concern) because someone is making that final rating judgment.

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Give us your feedback! Send comments about this lesson to ehpscienceed@niehs.nih.gov.

Student Instructions: Beauty or the Beast?

Step 1: Read the article "California Enacts Safe Cosmetics Act."

Step 2: Read the following information from an article (http://www.cfsan.fda.gov/~dms/fdconfus.html) on the U.S. Food and Drug Administration (FDA) website. The FDA is the regulating body for the safety of cosmetic and toiletry products sold in the United States:

The regulatory requirements governing the sale of cosmetics are not as stringent as those that apply to other FDA-regulated products. Under the Federal Food, Drug, and Cosmetic (FD&C) Act, cosmetics and their ingredients are not required to undergo approval before they are sold to the public. Generally, FDA regulates these products after they have been released to the marketplace. This means that manufacturers may use any ingredient or raw material, except for color additives and a few prohibited substances, to market a product without a government review or approval.

Some of the more common terms that consumers should be aware of include:

- Natural: implies that ingredients are extracted directly from plants or animal products as opposed to being produced synthetically. There is no basis in fact or scientific legitimacy to the notion that products containing natural ingredients are good for the skin.
- Hypoallergenic: implies that products making this claim are less likely to cause allergic reactions. There are no prescribed scientific studies required to substantiate this claim. Likewise, the terms "dermatologist tested," "sensitivity tested," "allergy tested," or "non-irritating" carry no guarantee that they won't cause skin reactions.
- Alcohol Free: traditionally means that certain cosmetic products do not contain ethyl alcohol (grain alcohol). Cosmetic products, however, may contain other alcohols, such as cetyl, stearyl, cetearyl, or lanolin, which are known as fatty alcohols.
- Fragrance Free: implies that a cosmetic product so labeled has no perceptible odor. Fragrance ingredients may be added to a fragrance-free cosmetic to mask any offensive odor originating from the raw materials used, but in a smaller amount than is needed to impart a noticeable scent.

Step 3: Look at the labeling of the product you are assessing for this activity. Does your product use any of the above descriptions (natural, hypoallergenic, alcohol free, or fragrance free)? List the descriptions applied to your product.

Step 4: The U.S. government has documented more than 10,500 ingredients in cosmetic products, but only a small percentage of those chemicals have been tested for safety. Of those that have been tested, some have been identified as carcinogens (causes cancer), teratogens (causes birth defects), and reproductive toxicants (damages the ability to reproduce). Some of those chemicals are listed below. These chemicals have been rated as moderate to severe health hazards by the independent consumer research group called the Environmental Working Group (EWG). Step 6 of this activity discusses how the ratings were developed. Circle any chemicals below that are listed in the ingredients list of your cosmetic or toiletry product.

ACRYLONITRILE
AMINOMETHYL PROPANOL
BENZYL ALCOHOL
BHT
BUTYLPARABEN
BUTYL ACETATE
COCAMIDE DEA

DIAZOLIDINYL UREA
DIBUTYL PHTHALATE
DIMETHYL SULFOXIDE
ETHANOL
ETHYL ACETATE
ETHYLACRYLATE
ETHYLPARABEN
FORMALDEHYDE
FRAGRANCE (consists of unknown mixtures)
ISOBUTYLPARABEN
LAURAMIDE DEA
LEAD ACETATE
METHYL CELLOSOLVE
METHYLCHLOROISOTHIAZOLINONE METHYLISOTHIAZOLINONE
METHYLPARABEN
PEG-8
PETROLATUM
PETROLEUM DISTILLATES
PHENYLPHENOL
POLYVINYL ALCOHOL
POTASSIUM DICHROMATE
PROPYLENE GLYCOL
PROPYLPARABEN
SD ALCOHOL 40B
SODIUM BENZOATE
THIMEROSAL
TRIETHANOLAMINE
TOLUENE
TOSYLAMIDE/FORMALDEHYDE RESIN

Step 5: Based on the information you have read and collected about your product, do you think a national law similar to the California Safe Cosmetics Act and laws already in place in Europe is needed? Why or why not? Justify your answer with at least two logical points or arguments.

Step 6: Read the following and answer the question:

Anytime you read information or someone is making a claim that a product is safe or dangerous, you want to critically analyze where the information was obtained. Reliable sources will list their sources of information. Those sources should be unbiased, or have no financial stake in the outcome. The EWG claims to have obtained their information in the following way:

"EWG created a core database of chemical hazards and regulatory status from 37 individual assessments or databases from government agencies, academic institutions, or other credible bodies. Collectively, these data sources detail more than 29,000 unique chemical classifications now contained in a centralized database at EWG. This database formed the core of the hazard assessments that are integral to Skin Deep, which build on a pairing of this toxicity and regulatory database with EWG's ingredient database. The individual toxicity and regulatory data sources we compiled are listed by sequential number below.

"Known and probable carcinogens, reproductive and developmental toxins

"Primary references

- ACGIH (American Conference of Governmental Industrial Hygienists) 2004. ACGIH cancer classification system. [1]
- California EPA (California Environmental Protection Agency). 2005. Office of Environmental Health Hazard Assessment. Safe Drinking Water and Toxic Enforcement Act of 1986. Chemicals known to the State to cause cancer or reproductive toxicity. 27 May 2005. [2]
- ECB (European Chemicals Bureau). 2005. Classification and Labeling: Chemicals: Annex I of Directive 67/548/EEC. [3]
- EPA (U.S. Environmental Protection Agency). 2005. Integrated Risk Information System (IRIS). Evidence for human carcinogenicity based on 1999 guidelines. http://www.epa.gov/iris/index.html. [4]
- IARC (International Agency for Research on Cancer). 2004. Overall Evaluations of Carcinogenicity to Humans, as evaluated in IARC Monographs Volumes 1–88 (a total of 900 agents, mixtures and exposures). Last updated July 22 2004. [5]
- NTP (National Toxicology Program). 2005. Eleventh Report on Carcinogens, Eleventh Edition; U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program. [6]"

Would these sources be considered reliable or unreliable, biased or unbiased? Why or why not? Include logical points or arguments to support your answer.