For the past six summers, the Northwest Association for Biomedical Research (NWABR) has provided an in-depth weeklong professional development program for teachers titled “Ethics in the Science Classroom.” This program, funded by a Science Education Partnership Award from the National Center for Research Resources at the National Institutes of Health, has provided nearly 150 teachers with background in ethical reasoning and science content related to controversial issues. In addition, these teachers have prepared lessons related to ethics and science for use in their classrooms. Over 30 such lessons are available online at www.nwabr.org. The website also provides the preliminary draft of an Ethics Primer, a resource guide containing interactive lesson ideas and background on ethics as a discipline. Through this workshop and subsequent discussions with teachers, we have developed a model that focuses on the three key components for effective classroom bioethics experiences.

Most of the secondary science teachers who shy away from incorporating ethics into their curricula are quite clear about the reasons they do so. Some teachers are uncomfortable with teaching ethics, a subject that science teachers often have very little experience with. Ethics as a discipline is full of unfamiliar terms and its own jargon. Other teachers fear classroom discussions getting out of control, degenerating into a battle of opinions, or having parents and administrators confuse teaching about values and morals with teaching particular values and morals. In addition, something as seemingly subjective as ethics can be perceived as somewhat out of place in a science classroom, where the focus is ostensibly on objectivity: “Why are we studying values in science class?” Ethics, to many teachers, seems like just one more element in an already crowded curriculum.

Keywords: Medical ethics at www.scilinks.org
Enter code: TST120501
key components for successful classroom bioethics experiences. In this article, I will review each component and discuss its use in the classroom.

**Why incorporate ethics into science teaching?**

Students often come to class discussions with preformed opinions on many ethical issues. The challenging task for teachers is to help students learn to identify the facts of a case, recognize the underlying ethical dilemmas, and to understand the different perspectives involved. Most students lack familiarity with ethics as a discipline and consequently are unable to articulate their stance or participate in a reasoned discussion about ethical issues in science. The role of the teacher includes encouraging students in their personal decision-making process while helping them learn to listen respectfully to the positions of others, to overcome prejudices, and to communicate their dissenting opinions reasonably and effectively. In such an educational setting, students are empowered to apply the same kinds of ethical reflection and critical thinking to difficult situations they encounter elsewhere in their lives.

Because bioethical issues offer no single right answers or simple solutions, they foster an understanding of the importance of logic and reason when approaching complex problems. Ethics provides an authentic, motivating context for understanding science and its relevance.

Three components are key to promoting effective discussions related to ethics and science: content and lesson strategies, a decision-making model, and a familiarity with ethical perspectives. These elements are represented in Figure 1 (p. 48).

**Content**

The content provides the “hook” for student engagement. Case studies make excellent starting points for ethical discussions and can be found in textbooks, on specialized websites such as [www.bioethics.net](http://www.bioethics.net), or can be taken directly from the news. Several publishers such as Greenhaven Press and McGraw Hill provide position papers on ethical issues related to science. Teachers who have participated in NWABR’s program have had success beginning a discussion with a movie or a vignette from a movie such as *Gattaca*. The Kennedy Institute of Ethics offers case studies freely available to teachers as well as lists of movies with bioethics themes. The institute also provides a film lending library (Kennedy Institute of Ethics 2005).
Suggested teacher guidelines for discussions, sample student discussion norms, and numerous lesson strategies are provided in the NWABR ethics primer (Chowning and Fraser 2005).

When evaluating an ethical dilemma involving science, students must have a solid understanding of the science behind the issue. Ethical dimensions of science should ideally be taught in conjunction with science content, rather than as an add-on when time permits. Not only does the study of ethics provide a social context for science, but it also creates a “need-to-know” that motivates students to learn the science content.

**Decision-making framework**

Traditional Science, Technology, and Society (STS) approaches have achieved limited success, mostly because they often lack a coherent pedagogical theory, attention to ethical issues, or focus on the moral development of students (Zeidler et al. 2005). These problems can be addressed by introducing students to models for critical reasoning, as well as by supporting understanding of ethical perspectives. Too often, teachers provide the starting content only and then ask students to discuss the issue or justify their positions. Pairing the content with a decision-making framework helps students organize their thoughts and craft their positions in a logical way. It may be instructive to have students reflect on the process they use when making decisions related to ethics in their own lives, and articulate their own model. While several decision-making models exist, the one developed by the Hastings Center (Jennings et al. 1990) is particularly useful and serves as the basis for the framework discussed in this article. A student handout version of the decision-making framework is provided in Figure 2.

**Ethical question**

First, the decision-making framework asks students to consider the ethical question. This is in itself not trivial—
different stakeholders would propose is one strategy. Solutions can be analyzed to consider which ethical principles are granted priority in each case.

**Decision and justification**

When presented with an ethical dilemma, students are apt to quickly jump to their decision/position, without a sense of their justification. Alternatively, students may express that their position is simply what they believe or what intuitively feels right. The justification of the decision is a key element of the model. This section allows students to practice clarifying their reasoning. Here is where students can bring in their understanding of ethical perspectives and theories (highlighted in the next section) in order to provide depth to their arguments. For example, ethical perspectives can help students clarify which of the possible solutions provides the best outcome for the greatest number (an outcome-based perspective). If students are working as a group, they can be asked to come to consensus or clarify the nature of their disagreement.

**Action/evaluation**

The last steps consist of acting on the decision and evaluating the decision. Students should be aware that they could change their decisions in light of new evidence or information. Many elements of this problem-solving strategy are shared with scientific decision-making processes. The focus is on a reasoned, thoughtful methodology rooted in critical thinking.

**Ethical perspectives**

In observations of ethics teaching in science classes, even a rudimentary introduction to ethical perspectives does much to deepen student discussion and involve-

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**FIGURE 2**

**Student handout: Ethical decision-making framework.**

<table>
<thead>
<tr>
<th>1. Ethical question: (Note: Questions such as “In which cases, if any, is the use of animals in research ethically justified?” “Is it ethical for scientists to pursue embryonic stem cell research?” or “How should donated organs be allocated” can be used here.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Relevant facts (known)</td>
</tr>
<tr>
<td>3. Questions that remain (unknown, need to know)</td>
</tr>
<tr>
<td>4. Stakeholders (people or entities affected by the decision)</td>
</tr>
<tr>
<td>5. Values/concerns of each stakeholder</td>
</tr>
<tr>
<td>6. Possible solutions</td>
</tr>
<tr>
<td>7. Decision and justification (refer to the ethical perspectives in your justification)</td>
</tr>
<tr>
<td>8. Take action and evaluate the process</td>
</tr>
</tbody>
</table>
Addressing the Standards.

The National Science Education Standards (NRC 1996) point clearly to the need for teachers to provide students with a solid understanding of ethical implications of science and the human context in which science occurs. The Standards state that understanding basic concepts and principles of science and technology must precede active debate of their economical, political, and ethical issues. Moreover, the Standards ask that students be able to understand and evaluate costs and benefits associated with technological advances. For example, Content Standard F: Science in Personal and Social Perspectives, indicates that all students should develop understanding of science and technology before debating local, national, and global challenges (NRC 1996, p. 199). Life Science Content Standard C describes the need for students to take informed positions on ethical aspects of developing biotechnologies (NRC 1996, p. 181).

ment in dilemmas. Some exposure to the discipline of ethics provides students with the language to give shape to their thoughts. Different ethical perspectives provide the basis from which students can consider what kinds of questions can be asked in an ethical dilemma.

Many teachers find it easiest to begin with what are widely referred to as the four principles of bioethics (The Belmont Report 1978; Beauchamp 2001): autonomy/respect for persons (respect an individual’s right to make self-determining choices); beneficence (do good); nonmaleficence (do no harm); and justice (treat others equitably, distribute benefits/burdens fairly). Beneficence and nonmaleficence are closely related and are sometimes grouped by ethicists under the broader heading of utility (Veatch 2003) and could also be combined for classroom use. Principle-based ethics provide a familiar form of reasoning for students and are fairly concrete for teachers as well. After becoming comfortable with principle-based ethics, teachers often progress to teaching about other ethical perspectives (Editor’s note: For a description of five major ethical perspectives along with definitions of the terms values, morals, and ethics, visit the online version of this article at www.nsta.org/highschool#journal.)

The three components described in this paper work synergistically in supporting informed ethical discussion in the science classroom. Teachers report that using these methods energizes their science students, often engaging individuals for whom science seems abstract or uninteresting. We hope that these strategies will allow teachers to more confidently address ethical issues in science with their students, thereby fostering student understanding of science as a social enterprise. The skills acquired by students are useful not only in the science classroom, but translate into lifelong skills for responsible citizenship.

Jeanne Ting Chowning (jchowning@nwabr.org) is Education Director for the Northwest Association for Biomedical Research, Seattle, WA.

References


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Editor’s Note

Clones, Cats, and Chemicals, published by NSTA Press, provides short readings that can initiate classroom discussions on ethics. For more information, visit NSTA’s Science Store at http://store.nsta.org.