### Module 6

**Modifying the Natural World: Human Responsibilities toward Animals**

#### Four Key Questions to Always Ask Yourself
- What is the ethical question?
- What are the relevant facts?
- Who or what could be affected by the way the question gets resolved?
- What are the relevant ethical considerations?

#### Ethical Considerations Relevant to This Module*

| **Respect** | • Do animals deserve respect? If so, what type of respect do they deserve?  
| • Are there certain types of changes or modifications that we should not make to animals? Why? |
| **Harms and Benefits** | • Should human benefits always outweigh animal harms?  
| • Is there a less harmful alternative? |
| **Fairness** | • Can companies or individuals patent modifications to life forms and limit the ability of others to use them (by charging fees or requiring permission)? |
| **Intrinsic Value** | • Do animals have value in their own right, or are they valuable only as they are useful to human beings? |
| **Responsibility (Stewardship)** | • What should our responsibilities be toward animals?  
| • What are some responsible policy approaches for handling the harms and uncertainty inherent in modifying animals? |

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*Bold items are emphasized in this module.

** The ethical consideration respect for persons is expanded in this module to include respect for the natural world.

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**See the Introduction**
For more information about the four key questions, see the Introduction, page 5.

**See Module 1**
Students are introduced to the four key questions and ethical considerations in Module 1. Modules 2–6 assume this prior knowledge. We strongly recommend that you complete Module 1 first with your students, before starting any of the other modules.
At a Glance

Issues Explored

- Should there be limits on the extent to which humans modify the natural world?
- Is the natural world important only because it is useful to human beings?

Purpose and Rationale

Over thousands of years, human beings have been developing technologies that modify the natural world. Today, people can alter plants and animals in more profound ways than ever before. Current and future modifications will undoubtedly bring enormous benefits, but they will also carry risks and uncertainties. Citizens will need to make decisions about the use of these modifying technologies. Such decisions should be grounded in an examination of humans’ place in the natural world and their responsibility to other life forms (also known as stewardship).

This module, which focuses on human modifications to animals, could be used in conjunction with units on DNA structure and function, biotechnology, evolution, genetics, ecology, food webs, and biodiversity. If used with another unit, the rabbit case study from Day 1 could introduce that unit.

Overview

In this module, students address ethical questions related to modifying the natural world. Although humans have been modifying their environment for thousands of years, modern technology has allowed people to modify animals in new ways that help them meet their needs. Which, if any, of these modifications are ethically acceptable, and under what circumstances? Students consider whether animals deserve respect, how to balance the harms to the animal and the benefits to human beings, and the relevance of less harmful alternatives to making the modifications.

Students first examine the case of Alba, a rabbit that was genetically modified to be fluorescent, and, using the ethical consideration of maximizing benefits while minimizing harms, decide whether the modification is justifiable. Students then apply their understandings from the Alba case to other cases of genetic modification of animals, weigh the harms and benefits, and consider the nature and extent of respect animals deserve. In a final assessment, students return to the Alba case and develop and justify policy recommendations based on the relevant scientific information and on the two ethical considerations, respect and harms and benefits.
Learning Objectives

Students will

• recognize that some technological interventions in the production and use of animals have the potential to bring benefits (and even possibly harms) to human beings as well as to harm, benefit, or have a neutral effect on animals;

• acknowledge that there is great uncertainty about the effects of these modifications and that it can be difficult to specify and evaluate their potential harms and benefits;

• recognize two critical ethical considerations: the harm-to-benefit ratio of a proposed modification—which includes examining the availability of an alternative that would be less harmful to the animal—and the concept of respect for animals; and

• become familiar with a range of policy approaches—prohibition, temporary moratorium, incrementalism, restricted pursuit, and no restrictions—for guiding human modifications of animals.

Major Concepts

• Human beings have been modifying the natural world for thousands of years to their great benefit.

• Technological breakthroughs now make it possible to modify animals on a scale and in ways never before imagined.

• Modifying the natural world brings great benefits but also risks and uncertainties.

• It is important to assess the ratio of expected animal harm to likely human benefit for a given modification and to determine whether there are better alternatives.

• Beyond the analysis of harms and benefits, it is important to determine the nature and extent of respect humans owe to animals.

• There is a range of policy approaches for handling these choices.

Assessment Outcome

Students will recommend one of five policy options for a decision about modifying Alba the rabbit for human entertainment and justify their recommendations. To do so, they will address what they perceive to be the ratio of animal harm to human benefit. They will also take into account other scientific and ethical considerations that support their policy recommendations.
Key Science Knowledge*

- DNA, RNA, protein, traits
- Ecosystem
- Genetic-modification and gene-insertion methods
- Implications of scientific interventions
- Mutation
- Phenotype, genotype
- Population dynamics
- Selective breeding, monoculture

*Bold items are explicitly addressed in this module.

Teaching Sequence Preview

Day 1—Exploring Modifications of the Natural World: As a group, students generate a list of human-made modifications to the natural world. They then read about the main case study of the module, involving a genetically modified rabbit named Alba, and they react to the ethical acceptability of the modification. To deepen their thinking about human modification of animals, students consider a range of cases that vary in the extent of human benefit and animal harm the modifications are likely to cause. As homework, students classify the modifications according to degree of human benefit and animal harm and decide whether or not—or maybe—each of the potential modifications should be allowed.

Day 2—Deepening Your Thinking: Some Key Ethical Considerations to Take into Account: Individual responses from the homework assignment are aggregated so that class results are visible to everyone, which underscores that these are difficult judgments and that reasonable people can disagree. Students begin to think about two key ethical considerations: the ratio of animal harm to human benefit—which includes the availability of a less harmful (to animals) alternative, if one exists, for gaining the human benefit—and the concept of respect. Students consider and discuss whether, in cases where the harms to animals are minimal or nonexistent, some people might still reasonably believe the modification was ethically unacceptable because it disrespects the animal. Students then have a chance to change their responses and if they do, to reflect on why they did so.

Day 3—Making a Recommendation: Selecting from a Range of Policy Options: Students return to the case introduced on Day 1. Now armed with the ideas from Day 2, they must decide whether they think the modification of Alba the rabbit should proceed. They choose a recommendation from a range of possible policy options that fall along a decision-making continuum: prohibition, temporary moratorium, incrementalism, restricted pursuit, and no restrictions.
In Advance

Copies, Equipment, and Materials

<table>
<thead>
<tr>
<th>Activity</th>
<th>Photocopies and Transparencies</th>
<th>Equipment and Materials</th>
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</thead>
<tbody>
<tr>
<td><strong>Day 1</strong></td>
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<tr>
<td>2</td>
<td>1 copy of Master 6.1 for each student</td>
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<tr>
<td>3</td>
<td>• 1 transparency each of Masters 6.3 and 6.4 for the class • 1 copy of Masters 6.2, 6.3, and 6.4 for each student</td>
<td>1 overhead projector for teacher use</td>
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<tr>
<td><strong>Day 2</strong></td>
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<td>4</td>
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<td>Chart paper for Assessment of Ethical Acceptability poster; 24 red, 24 green, and 24 yellow stickers for each student*</td>
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<tr>
<td>8</td>
<td>1 transparency of Master 6.5 for the class</td>
<td>1 overhead projector for teacher use; Assessment of Ethical Acceptability poster created on Day 2; 24 red, 24 green, and 24 yellow stickers for each student*</td>
</tr>
<tr>
<td>9</td>
<td>1 copy of Master 6.6 for each student</td>
<td>1 overhead projector for teacher use</td>
</tr>
</tbody>
</table>

*If you don’t have stickers, students can use red, green, and yellow markers or pencils; it’s possible to use just one color, but you’ll have to adjust the instructions, which assume that students are using three.

Masters

Master 6.1: Alba’s Case
Master 6.2: Contrasting Cases of Animal Modifications
Master 6.3: Assessment of Ethical Acceptability
Master 6.4: Assessing Harms, Benefits, and Potential Alternatives
Master 6.5: Decision-Making-Continuum Terms and Definitions
Master 6.6: Final Assessment of Alba’s Case

Teacher Support Materials*

Sample List of Modifications
PowerPoint Presentation: Case Photos
Creating Transgenic Organisms


More on the Web

Day 1 introduces students to the concept of modifying the natural world. They begin by broadly exploring such modifications and then find out that in this module, because of time constraints, they will focus on modifications to animals. First, students offer preliminary views about the ethical acceptability of inserting a gene for fluorescence into rabbits. Then, they classify a range of cases in terms of the degree of animal harm and human benefit each modification is likely to yield.

**Activity 1:**
SEEKING PRIOR KNOWLEDGE—INTRODUCING THE TOPIC

**Estimated Time:** 5–10 minutes

**Procedure**

1. **Tell students that for thousands of years, humans have been modifying the natural world.**

   For example, for centuries, humans have taken apples from the wild and mixed varieties to develop better tasting and more nutritious ones. Today, we have hundreds of varieties. Another example is triticale, a hybrid between wheat and rye first developed in the late 19th century, with the most desirable qualities of each. It’s used now mainly for forage or feed for livestock.

   Animal breeding has produced horses, cattle, pigs, chickens, and even salmon with a wide variety of desirable characteristics. An example of a recent animal modification is the Labradoodle dog, created in 1989. The goal was to combine the low-shedding coat of the poodle with the gentleness and trainability of the Labrador retriever. Developed as a guide dog for individuals with allergies to dander and fur, the Labradoodle has become an extremely popular breed.

2. **Ask students to generate a list of ways humans have modified the natural world. As students share their ideas, record the list for the class to see.**
The goal of making this list is to encourage students to start thinking about what they already know about the topic, not to be exhaustive or to include only right answers. You can use a variety of means—for example, a chalk talk or an oral discussion—to engage students in generating the list.

You may want to use these questions as a springboard to generating the list:

- How have people modified plants?
- Have people modified animals? How?
- Have people modified the environment? How?

See Teacher Support Materials

You can develop your own prompting questions to help students generate ideas. A sample list of modifications is available online at http://science.education.nih.gov/supplements/bioethics/teacher.

3. Explain to students that—due to time constraints—this module will focus only on human modification of animals.

**Activity 2:**

**Introducing Alba’s Case**

Estimated Time: 10–15 minutes

**Procedure**

1. Give each student a copy of Master 6.1: Alba’s Case.

   See Teacher Support Materials

   A color photo of Alba, who glows fluorescent green under blue light, is available in a PowerPoint presentation with the rest of the case photos online at http://science.education.nih.gov/supplements/bioethics/teacher. You can show the photo to students as you introduce them to the case.

2. Allow time for students to read Master 6.1, or read it together as a class.

3. Briefly answer students’ questions about the facts of the case.

   See Teacher Support Materials

   Background information for you about creating transgenic organisms is available online at http://science.education.nih.gov/supplements/bioethics/teacher.

**Note**

The intent of introducing Alba’s case here is to get students to begin thinking about what they believe is and is not ethically acceptable. It is meant to be an introductory “teaser.” Students will have initial gut reactions to all the cases. The rest of the module is intended to help them become more thoughtful about their responses, and they get a chance to think more deeply about Alba’s case on Day 3.

**Note**

Information about creating transgenic organisms is also available in the References and Resources section on page 6-28, through the links to articles about Alba’s case.
4. Ask students for their preliminary views about the case.

Possible questions to draw students’ responses include
- Who believes that making Alba was ethically acceptable? Why?
- Who believes that it was ethically wrong to make Alba? Why?
- Who is not sure about what they think? Why?

5. Point out that reasonable people can disagree about what is the right thing to do in Alba’s case.

It can be difficult to decide whether human modification of animals is ethically acceptable, partly because there are so many things to consider. One way to deepen students’ thinking about this issue is to engage them in analyzing a range of cases. Through contrast and comparison, their thinking may get more subtle and sophisticated. After they spend some time exploring a range of cases, they will have a chance to return to Alba’s case on Day 3.

**Activity 3:**
**Contrasting Cases of Animal Modification**

Estimated Time: 20–25 minutes

In this activity, you introduce students to a wide range of animal-modification cases. For homework, students classify the modifications in terms of their expected benefit to humans and degree of harm to animals. Also for homework, students quickly and privately record their first impressions: “yes,” the modification should be allowed; “no,” it should not; or “maybe.”

**Procedure**


2. Allow time for students to read the cases, or read them together as a class.

   - **See Teacher Support Materials**
     As you introduce each case, you might want to show students the color photograph of the animal in the PowerPoint presentation available online at http://science.education.nih.gov/supplements/bioethics/teacher.

4. Explain that as homework tonight, students will record their initial reactions to the cases (Round 1) on Master 6.3, read the cases again focusing on the factual descriptions of harms and benefits, and decide where they would place each case in the matrix on Master 6.4.

5. Show the transparency of Master 6.3, and read the directions together. Tell students that they will be using this worksheet later in the module, too.

Students should place their initial, gut reactions in the Round 1 column. They should check “yes” if they would recommend proceeding with the described modification, “no” if they recommend prohibiting the modification, or “maybe” if they are not sure what to recommend. After students finish Round 1 on Master 6.3, they should complete Master 6.4.

6. Show the transparency of Master 6.4, and read the instructions together.

Master 6.4 is a blank table labeled with the magnitude of benefits to humans (three columns—small, medium, large) and the magnitude of harms to animals (four rows—small, medium, large, unknown).

The homework assignment is to write the name of each case in the most appropriate cell of the table. This will create a visual display of how the cases vary in terms of degrees of human benefit and animal harm. It is fine to have more than one case in each cell, or no cases in some of the cells.

The master instructs students to make an asterisk (*) next to a case name if they think there is an alternative that brings the human benefit without the animal modification. Considering less harmful alternatives is an important part of assessing whether a government should allow people to make a modification to an animal. The fact that an alternative is less harmful to animals may not be a sufficient reason to seek the alternative, however. Other considerations to take into account include the cost of the alternative, how difficult achieving the alternative is, and how beneficial to humans it is compared with the original case.

7. Ask students, “Do you have any questions about the facts of the case that have not been fully addressed—or addressed at all—whose answers might change your mind?”

If the class runs out of time, tell students to research their questions for homework. Make sure they understand that for some of these modifications, scientists do not yet know what the degrees of human benefit and animal harm might be. If that is so, the case description states that these benefits and harms are unknown. Later, when students reassess the acceptability of these modifications, they will have to consider how important this uncertainty is: is it reason enough to forbid such a modification, to proceed with caution, or to go ahead?
8. Tell students to come to the next class session prepared to explain why they responded as they did to Masters 6.3 and 6.4. If there’s time, students can start their homework during class.

**Closure**

Reinforce to students that human beings have been modifying the natural world for thousands of years to their great benefit, and technological breakthroughs now make it possible to modify it in ways never before imagined. Emphasize that while modifications bring great benefits, they also bring risks and uncertainties. To evaluate these modifications thoughtfully, it is important to examine harms and benefits, the availability of alternatives, and the nature and extent of respect owed to plants, animals, and other parts of the natural world. These ethical considerations are the focus of Day 2.

**Homework**

For homework, have students complete Round 1 on Master 6.3 and Master 6.4 as explained above.

**Extension (Optional)**

If there is a specific scientific concept that students have not yet studied in any of the cases, such as transgenic organisms, you may wish to give them time to work on those cases before proceeding to Day 2.
### Organizer for Day 1:
Exploring Modifications of the Natural World

#### Activity 1: Seeking Prior Knowledge—Introducing the Topic
Estimated Time: 5–10 minutes

Tell students that for thousands of years, humans have been modifying the natural world; you could mention apples, triticale, and Labradoodles.  

Ask students, “How have people modified plants? Animals? The environment?” Record the answers for the class to see.  

Explain that this module—due to time constraints—will focus on human modification of animals.

#### Activity 2: Introducing Alba’s Case
Estimated Time: 10–15 minutes

Give each student a copy of Master 6.1. Allow time for students to read the case, or read it together as a class.  

Briefly answer questions about the facts of the case.  

Ask students for their preliminary views about the case.  

Say that reasonable people can disagree about what to do in Alba’s case.

#### Activity 3: Contrasting Cases of Animal Modifications
Estimated Time: 20–25 minutes

Give each student a copy of Master 6.2. Allow time for students to read the cases, or read them together as a class.  

Give each student a copy of Master 6.3 and Master 6.4, and explain tonight’s homework.  

Read the directions on the transparencies of Master 6.3 and Master 6.4 together. Ask for questions about the facts of the case that have not been fully addressed.  

Tell students to be prepared to explain their homework answers.  

**Closure:** Reinforce to students that technological breakthroughs have made it possible to modify the natural world in ways never before imagined.  

**Homework:** Complete Master 6.3’s Round 1 and Master 6.4.  

**Extension (optional):** Have students research case-related scientific concepts they’re not familiar with.

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**M** Involves copying a master  
**T** Involves making a transparency
**DAY 2: Deepening Your Thinking—**
Some Key Ethical Considerations to Take into Account

**Purpose**

The purpose of Day 2 is for students to share their preliminary views about the ethical acceptability of the range of modifications they thought about for homework. They record their views on a large poster in the front of the room, discovering what their classmates thought and looking for patterns in the group results. Then, they examine pairs of cases to better analyze what ethical considerations to take into account when judging the acceptability of a given modification. Two key ethical considerations are highlighted: 1) harms and benefits—specifically, the ratio of animal harm to human benefit (including the availability of alternatives that could bring the benefit to humans with less harm to the animals), and 2) respect—specifically, the concept of respect for animals.

**Activity 4: Generating a Range of Responses**

Estimated Time: 15–20 minutes

In this activity, students share their initial reactions to the cases they examined for homework.

**Procedure**

1. Before class, create a poster titled “Assessment of Ethical Acceptability” on chart paper that looks like the table below. If the class is using just one color sticker or marker, make three columns under both “Round 1” and “Round 2” and label them “yes,” “no,” and “maybe.”

<table>
<thead>
<tr>
<th>Assessment of Ethical Acceptability</th>
<th>Case</th>
<th>Round 1</th>
<th>Round 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheared Wooly Sheep</td>
<td></td>
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<tr>
<td>Immunoglobulin Cows</td>
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<tr>
<td>Mad-Cow-Disease Cows</td>
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<tr>
<td>Super-Sized Salmon</td>
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<tr>
<td>Giant Panda Breeding</td>
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<tr>
<td>Purebred Dogs</td>
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<tr>
<td>Spider-Silk Goats</td>
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<tr>
<td>Dyed Feathers</td>
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<td></td>
<td></td>
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<tr>
<td>Disease-Model Mice</td>
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<tr>
<td>Ear Mice</td>
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<td></td>
<td></td>
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<tr>
<td>Malaria Mosquitoes</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Veal</td>
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</tbody>
</table>
2. Tell students that today they are going to share and discuss their homework responses with the rest of the class.

3. Give students green, red, and yellow stickers (or markers or pencils).

4. For each case, have students refer to Master 6.3, which they filled out for homework.

5. Ask students to choose a color sticker that represents the view they recorded on Master 6.3 the night before—green to allow the modification to proceed, red to stop the modification, and yellow to indicate caution or uncertainty.

6. Ask students to walk up individually to the master chart to place their stickers next to each case for Round 1. Alternatively, depending on the dynamics of your class, you could ask all students who chose a given color to raise their hands so that you can place the appropriate number of colored stickers in the appropriate column beside each case.

7. **Start the analyses:** After you or your students have placed the stickers on the poster, ask them to look at the resulting pattern.

   It is impossible to predict which cases will get the most green, yellow, or red stickers. However, the cases are listed from top to bottom according to a roughly expected pattern of most acceptable (least concerning) to least acceptable (most concerning).

8. **Draw students’ attention to areas of agreement by asking, “Which cases have the greatest numbers of stickers with the same color?”**

   • Which cases have the greatest numbers of green stickers? This shows that most students think that those modifications are acceptable.
   • Which cases have the greatest numbers of red stickers? Those stickers represent the number of students who think that those kinds of modification are not acceptable.
   • Which cases have the greatest numbers of yellow stickers? Those students are uncertain about the acceptability of those modifications.

   It is likely that the extreme cases (top and bottom of chart) will have the most green and red stickers, respectively.

9. **For the cases with the greatest numbers of green stickers, ask students to explain why they made the choices they did. Ask the same question for the cases with the greatest numbers of red stickers.**

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**Note**

The order of the cases is not meant to signal a right or wrong answer to the question of each modification’s ethical acceptability. Instead, it’s meant to facilitate a process of systematically examining and discussing the cases and differences among the cases. Indeed, across the classroom, there should be a range of opinions about the ethical acceptability of each modification.
10. Call attention to unpopular opinions. Tell students that the sign of a healthy ethical discussion—one where people are giving good reasons for their positions—is the expression of a range of views that concerned stakeholders can examine and analyze with equal scrutiny and respect.

Ethics is not about a popularity contest or a majority vote. In fact, consensus in a group can lead to “group think” and squelch more in-depth ethical reasoning. Reasons are the key, not votes. With that in mind, look at the results to identify places where there was an opinion that stands out as different from others. For example, if a particular modification got many green stickers but only one or two yellow or red stickers, ask whether students who posted the yellow or red stickers would be willing to explain their thinking.

Activity 5: Assessing Harms and Benefits
Estimated Time: 15 minutes

In this activity, students are asked to think in greater depth about harms and benefits for some of the cases. This should help them understand that the ratio of animal harm to human benefit is an ethical consideration to take into account in their analyses.

Procedure

1. Select a case at either end of the list in Master 6.3 to discuss. For a case at the top of the list, ask someone who gave it a green sticker why he or she did so. Then, ask that same person whether there was a case he or she gave a red sticker to.

2. Ask the student, “Why? What is different about these cases that made you approve one and not the other?”
Students might bring up harms and benefits. They might also bring up the notion of respect for animals. List on the board or chart paper all the considerations students mention.

3. Ask another volunteer—one who ranked one case green and another red—“What do you think is different about the cases?”
List all the considerations students bring up, but this time, focus the whole class on the issue of harms and benefits. (In Activity 6, the class will focus on respect.)

4. Focus students on the different degrees of harms and benefits. Ask students, “Which cases are most likely to yield great human benefit? Which are not? Which cases are most likely to yield great animal harm? Which are not?”
You may wish to note that

- Cases at the top of the list, where there are likely more green stickers, are more likely to yield greater human benefit, lesser animal harm, or both.
- Cases at the bottom of the list, with more red stickers, will probably offer less human benefit, greater animal suffering, or both.
- This does not mean that it is automatically correct to approve of a modification in a green case or to disapprove of one in a red case. However, it does mean that the cases differ in the ratio of harm to benefit, which is one factor many people will want to consider when assessing the acceptability of modifications.

5. To address the middle cases—likely to have the most yellow stickers—ask students, “If you chose a yellow sticker, what about the case made you cautious?”

6. Tell students that in the modifications marked “maybe,” the benefits to humans are likely to be less dramatic and the potential harms to animals to be worse or more uncertain.

7. Explain that harms and benefits as well as uncertainty about harms and benefits are important ethical considerations, which people should take into account when considering which animal modifications should be acceptable and which should not.

Minimizing Harms While Maximizing Benefits: Acting to lessen negative outcomes and promote positive outcomes.

8. Tell students that to move from their initial gut reactions to a more considered opinion, it’s important to ask,

- What is the likely benefit to humans?
- What are the likely nature and extent of harm to the animal?
- Does the ratio of animal harm to human benefit make the modification ethically acceptable?

9. Explain that there is another important question to ask in an analysis of harms and benefits: Is there any alternative to using animals in this way that would still bring the hoped-for human benefit? If so, what are the harms and benefits of the alternative?

10. Point out that the immunoglobulin-cow case has an alternative approach that would be less harmful to the cows and ask, “Does the existence of that alternative make any of you wish to change your recommendation?”

Some students might point out that the alternative in the immunoglobulin-cow case is very expensive. This is a relevant (economic) harm to humans. Students should recognize that the availability of an alternative approach to gaining the benefit might change their evaluation of the acceptability of the modification.
11. Ask students, “Should human benefits always outweigh animal harms?”

There will likely be students who do not believe that harm to animals should count for very much or—in rare cases—anything at all. On the other hand, some students may consider that harm to animals and harm to humans carry equal weight. Clearly, the relative weight assigned to harm to animals will greatly affect students’ final analysis.

12. Refer students to the purebred-dog case or the dyed-feathers case and ask, “Do you believe that manipulating dogs’ genetic characteristics or changing the color of a chick for human purposes—such as to hunt, to guard, to be aesthetically pleasing—is always ethically acceptable? When might it not be acceptable?”

Students will likely want to distinguish cases in which the dog is bred to hunt from those in which it’s bred for aesthetic purposes. In the latter case, some students might think that dog-breeding practices yield too big an animal harm for too small a human benefit. Other students might think that the harm to animals and the benefit to humans are not great. Even then, students might still find the modification unacceptable.

13. To conclude the discussion and prepare students for the next activity, ask them to start thinking about this: What about cases in which there are no, or only slight, animal harms? Is it always acceptable to make these modifications?

**Activity 6:**
**Exploring Respect as an Ethical Consideration**
**Estimated Time: 15 minutes**

In this activity, you introduce students to the concept of respect and engage them in a guided discussion of specific cases. It should be apparent by now that the likely harms to animals and expected benefits to humans are not the only reasons students have for their choices. The stickers will most likely show that there are some who think that even if the animal harms are small, the modification should not be made, while others are undeterred by substantial harms to animals.

**Procedure**

1. Tell students who are still concerned by cases that include small harms to animals that it appears they may have made decisions about the cases for reasons other than harms and benefits.

They will discuss some of these reasons in this activity.
2. Direct students to turn to their responses on Master 6.4.

3. Ask students, “Did you put any of the cases in the ‘Small’ Harm to Animals row? Which ones?”

The dyed-feathers case poses very little harm to the chicks and offers very low human benefit. Some students probably approved this modification, and others may have objected to it.

4. Ask a student who placed a red or yellow sticker next to the dyed-feathers case on the poster to explain why he or she did that. You can address the question to the class if specific students do not wish to speak up.

5. Ask students, “Why is it ethically acceptable to treat some things, like pencils, solely as a means to human benefit, but it is not ethically acceptable to treat one human being solely as a means to benefit other human beings?”

6. If it does not come out in the discussion, explain that humans are not to be treated solely as means to an end, even when the end involves significant benefits to many human beings.

Not treating someone solely as a means to an end is one way people show respect to each other. For example, even though a doctor could save five patients by killing just one person and transplanting all of that person’s organs to the five people, that is not ethically acceptable. If a doctor cares for a patient to the best of her ability, she is treating the patient as both a means (to support herself and her family) and an end (to make the patient healthy), which is acceptable.

7. Explain that placing a green sticker next to a case indicates that it is acceptable to treat animals as a means to humans’ ends in that case.

8. Ask students, “Do you believe that animals might also deserve respect and that people should not always treat them as a mere means to human benefit? Why or why not?”

**Respect for Animals:** Not treating animals as merely useful for human purposes.

You may wish to use the following questions to deepen and expand the discussion:

- What does deserving respect entail for an animal?
- What are the limits to how scientists can modify animals for the benefit of humans?
- What should our responsibilities be toward animals?
• One limit is when harms are too great, and people may disagree about when harms become too great. But what about cases like the dyed-feathers case, when there are no, or very rarely, harms to the animals? Are these kinds of modifications disrespectful to animals?

• What kind of life forms deserve respect? Only humans? Only mammals? How about worms, bacteria, viruses? What is the essential quality that a life form must possess to deserve respect?

Continue to probe students’ opinions about these questions. They will likely be attempting to articulate a respect argument.

**Closure**

Sum up the discussion, and ask students to name the two major ethical considerations they have been taking into account as they consider which modifications humans should and should not make to animals.

Be sure that these three main points are mentioned:

• In the ratio of animal harm to human benefit, the greater the benefit to humans and the lesser the harm to animals, the more likely a modification will be assessed as ethically acceptable.

• The availability or lack of availability of a less harmful alternative for gaining the human benefit will influence the acceptability of the modification.

• Concerns about respect for animals might lead some students to think that animals should not be a means to humans’ ends without limitation.

**Homework**

Now that students have had an opportunity to examine the ethical considerations in detail, they may have changed their opinions about the ethical acceptability of the modifications. Assign students to complete Round 2 on Master 6.3, using their experience from today’s discussion.
**Organizer for Day 2:** Deepening Your Thinking—Some Key Ethical Considerations to Take into Account

### Activity 4: Generating a Range of Responses
**Estimated Time:** 15–20 minutes

Before class, create a poster on chart paper titled “Assessment of Ethical Acceptability.”

Tell students they will now discuss last night’s homework.

Give students green, red, and yellow stickers (or markers).

Have students refer to their filled-out Round 1 of Master 6.3 as they, in turns, place the appropriate colors of stickers on the chart paper.

Ask students to look at the resulting pattern on the chart. Ask, “Which cases have the greatest numbers of stickers with the same color?”

Ask students to explain why they made the choices they did for the cases with the greatest number of green stickers, and then of red stickers.

Call attention to unpopular opinions. Tell students that the sign of a healthy ethical discussion is the expression of a range of views that concerned stakeholders can examine and analyze with equal scrutiny and respect.

### Activity 5: Assessing Harms and Benefits
**Estimated Time:** 15 minutes

Select a case at either end of the Master 6.3 chart. For a case at the top, ask someone who gave it a green sticker why he or she did so. Then, ask that same person whether there was a case he or she gave a red sticker.

Ask the student, “Why did you approve one and not the other?”

Ask another student—who ranked one case green and another red—“What do they you think is different about the cases?” Record all considerations students mention on the board or chart paper.

Focus students on the different degrees of harms and benefits.

To address the middle cases—likely to have the most yellow stickers—ask students, “If you chose a yellow sticker, why were you cautious?”

Tell students that in the “maybe” modifications, the benefits to humans are likely to be less dramatic and the potential harms to animals to be worse or more uncertain.

Explain that harms and benefits as well as uncertainty about harms and benefits are important ethical considerations.
Tell students that to move from their initial gut reactions to a more considered opinion, it’s important to ask, What is the likely benefit to humans? What is the likely nature and extent of harm to the animal? Is the ratio of animal harm to human benefit sufficient to make proceeding ethically acceptable?

Tell them that two more important questions are, Is there any alternative to using animals in this way that would still bring the hoped-for human benefit? What are the harms and benefits of the alternative?

Point out that the immunoglobulin-cow case has an alternative approach that would be less harmful to the cows and ask, “Does the existence of that alternative make anyone wish to change their recommendation?”

Ask, “Should human benefits always trump animal harms?”

Referring to the purebred-dog case or the dyed-feathers case, ask, “Do you believe that these manipulations for human purposes should always be acceptable? When might they not be acceptable?”

Ask students to start thinking about the question, In cases where there are no, or only slight, animal harms, is it always acceptable to make these modifications?

**Activity 6: Exploring Respect as an Ethical Consideration**

**Estimated Time: 15 minutes**

Tell students who are still concerned by cases that include small harms to animals that they may have made their decisions based on reasons other than harms and benefits. They will discuss some of these other reasons next.

Direct students to turn to Master 6.4 and ask them, “Did you put any of the cases into the ‘Small’ Harm to Animals row? Which ones?”

Ask a student who placed a red or yellow sticker next to the dyed-feathers case on the class poster to explain why.

Ask students, “Why is it ethically acceptable to treat some things, like pencils, solely as a means to human benefit, but it is not ethically acceptable to treat one human being solely as a means to benefit other human beings?”

Emphasize that humans are not to be treated solely as means to an end, even when the end involves significant benefits to many human beings.

Explain that placing a green sticker next to a case indicates that it is acceptable to treat animals as a means to humans’ ends in that case.

Ask students, “Do you believe that animals might also deserve respect and that people should not always treat them as a mere means to human benefit? Why or why not?”

**Closure:** Sum up the discussion, and ask students to name the two major ethical considerations they have been taking into account today.

**Homework:** Complete Round 2 on Master 6.3.
DAY 3: Making a Recommendation—
Selecting from a Range of Policy Options

PURPOSE

The purpose of Day 3 is to introduce students to the process of making policy recommendations for the human-animal cases using a decision-making continuum. The day’s activities integrate the concepts of previous days. Students will then return to Alba’s case, introduced on Day 1. They should take both the scientific facts and the ethical considerations into account when they make a recommendation for this case.

ACTIVITY 7:
Summing Up the Ethical Considerations
Estimated Time: 10–15 minutes

The purpose of this activity—which you should move through quickly—is to give students the opportunity to compare their responses before and after discussing the ethical considerations. Their Round 2 views will be used to formulate policy recommendations for the final assessment.

PROCEDURE

1. Ask students to review their homework, Round 2 on Master 6.3.

2. Invite students to follow the procedure from Day 2 for placing stickers on the class poster to match their Round 2 recommendations. This time, students will place green, yellow, or red stickers under the Round 2 column.

3. Ask students, “How has the pattern changed, if at all, from Round 1?”

Possible questions to draw students’ responses could include

• Why do you think there have been shifts in some of the stickers?
• For those of you who placed a different color sticker next to a case in Round 2 than you did in Round 1, why did you change your sticker placement?

4. Reemphasize that students’ reactions in Round 2 may differ from Round 1, after they have thought more deeply about the ethical considerations.

Even if their decisions about the ethical acceptability of the case have not changed, by thinking about the ethical considerations, students’
reasoning for their recommendation should now be more sophisticated. In the next activity, students will have a chance to demonstrate their thinking in more detail. Notice the reasons students give for their policy recommendations. They should mention at least one of these reasons:

- Harms to the animals are too great and the benefits to humans too small to warrant proceeding with the modification.
- Harms to the animals are great but the likely benefits to humans are also great; proceed cautiously with the modification and/or actively seek alternative options.
- Harms to the animals are small or modest but the likely benefits to humans are great; proceed.
- Some things, no matter their potential human benefit, are simply disrespectful of the animal, treating it as a mere means to human benefit. Such actions should not be allowed to proceed.

**Activity 8:**
**Using a Decision-Making Continuum—Options for Policy Makers**

Estimated Time: 10–15 minutes

In this activity, students use a decision-making continuum as they develop policy recommendations. There is often a range of acceptable ways to respond to ethical questions, and reasonable people can disagree. The key is to have reasons for one’s views. Students participate in an activity to illustrate their understanding of the terms and provide an explanation for their views.

**Procedure**

1. Display just the terms at the top of the transparency of Master 6.5: Decision-Making-Continuum Terms and Definitions, and ask students to discuss what they think each term means.

2. Display the whole transparency of Master 6.5, and go over the definitions of the terms.

3. Tell students that to help them understand the meanings of these terms, they will now consider some examples.

4. Draw students’ attention to the bottom of the Assessment of Ethical Acceptability poster for Round 2, where red stickers probably predominate. Pick a case near the bottom, and ask students who put red stickers there what they think the policy recommendation should be for that case. Ask them their reasons for their recommendation.
Those cases where students do not think the modification should be made (red stickers) should correspond to a policy recommendation of prohibition or temporary moratorium.

**Likely case:** veal

**Likely reasons:** (a) the harms to the animal are great and the benefits to humans small and (b) it is disrespectful to the animal.

5. **Move up from the bottom and draw students’ attention to where the red and yellow stickers start to mingle.** Pick a case from there, and ask students to explain why they think these policy recommendations fit best here.

These cases may correspond to the restricted pursuit or the incrementalism policy recommendation.

**Likely case:** malaria mosquito

**Likely reason:** the impact on the mosquito species, the predators of the mosquitoes, and even human health is unknown and could possibly be very negative. But the potential benefits to human health are great. So, some students might recommend that the modifications proceed only in a controlled setting (in a lab) until more information can be gathered.

6. **Pick a case where yellow stickers predominate, and ask students to explain which policy recommendations best match that case. Ask them their reasons for their recommendation.**

These should also correspond to incrementalism and restricted pursuit.

**Likely cases:** disease-model mouse, dyed feathers, spider-silk goats

**Likely reasons in the disease-model-mouse case:** the harm to animals is great but the benefit to human beings is also great, so some students might recommend limiting the number of mice that can be used as disease models. Over time, alternatives may become available, so some students will recommend that research on animals should be periodically reassessed in light of new alternatives.

**Likely reasons in the spider-silk goats and dyed-feather cases:** the harm to animals is small, but some students might think it’s disrespectful to use animals in this way except when the benefit to human beings is great.

7. **Move up the chart to where the yellow and green stickers start to mingle, and ask students which policy recommendations they think fit best here. Ask them their reasons for their recommendation.**

These cases may elicit the response of incrementalism and no restrictions.

**Likely cases:** purebred dogs, giant panda breeding, super-sized salmon

**Likely reasons in the purebred-dogs and super-size-salmon cases:** the harm to animals is small, but some students might think it’s disrespectful to use animals in this way except when the benefit to human beings is great.

**Likely reasons in the giant panda-breeding case:** it benefits the panda species by ensuring that it will continue to exist, and it benefits human beings who learn about pandas by going to the zoo.
8. Pick a case with predominantly green stickers, and ask students which policy recommendation fits best here and why.

These cases may elicit the response of no restrictions.
**Likely cases:** sheared wooly sheep, immunoglobulin cow, mad-cow-disease cows
**Likely reasons in the sheared-wooly-sheep and immunoglobulin-cow cases:** the harm to animals is small and the benefit to humans is great.
**Likely reasons in the mad-cow-disease-cow case:** the harm to animals is small and the benefit to animals and humans is great.

### Teaching Strategies

Another way to conduct this discussion might include asking for students’ reasons by getting them to compare two cases at a time (for example, a case where they put a green sticker and one where they put a yellow or red sticker).

Some students might offer views such as these:

- “In the veal case, the animal harm is too big and the human benefit too small, and in the mad-cow-disease case, the animals benefit a lot and the humans benefit a lot—it’s win-win.”
- “In the malaria-mosquito case, the harms to humans and animals are not known and might be really bad, so there should be a moratorium.”
- “It’s disrespectful to the ear mouse to use it as a means to human benefit.”

### Activity 9: Returning to Alba’s Case

**Estimated Time:** 20–25 minutes

#### Procedure

1. **Distribute Master 6.6: Final Assessment of Alba’s Case,** a worksheet students will use to determine and justify the policy approach they recommend for Alba’s case.

   They will be making a recommendation about whether it is ethically acceptable to create Alba for an art show.

2. **Break the class into groups of approximately four students.** Ask each group to decide what policy approach they recommend for Alba’s case, being sure to consider and respond to the arguments of each member of the group.

   Each group should provide a comprehensive reason for the approach they chose. The worksheet is structured to encourage students to take into account all the major ethical considerations raised earlier in this module.
3. Ask a representative from each group to share the group’s recommendation to the class.

If a group cannot reach consensus, it’s fine to entertain a minority report, in which people who were not persuaded by the dominant argument state their opposition to the majority view.

4. Assign the final assessment (below) as homework.

**Closure**

Review with students that it’s normal to have an initial gut reaction to an ethical question. To reach a thoughtful response, people must examine the scientific facts of the case and the ethical considerations involved. Then, policy recommendations can be made that reflect an understanding of the facts and this reasoned approach.

**Homework**

Have each student complete an essay or poster containing his or her policy recommendation and reasoning for it. This will serve as the final assessment (see below).

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**Final Assessment**

The final assessment is the homework assigned at the end of Day 3.

In a well-written essay or poster presentation, each student should make a recommendation for the policy position he or she feels is best suited to Alba’s case, selecting from among the choices on the decision-making continuum. In justifying their recommendations, students should clearly articulate the key scientific facts, identify all the stakeholders, and take into account the ratio of animal harm to human benefit, available alternatives, and respect. The group work and full-class discussion of Days 2 and 3 should have served as an opportunity for students to clarify their thinking for this assignment.

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**See the Introduction**

Consider referring to Table 1, Assessing Student Justifications, on pages 10–11 of the Introduction. This table will help you evaluate how comprehensively and rigorously students handled the Final Assessment assignment.
Organizer for Day 3: Making a Recommendation—Selecting from a Range of Policy Options

Activity 7: Summing Up the Ethical Considerations
Estimated Time: 10–15 minutes

Ask students to review their homework, Round 2 on Master 6.3.

Follow the procedure from Day 1 for placing stickers on the class poster, this time for Round 2 recommendations.

Ask students, “How has the pattern changed, if at all, from Round 1?” Emphasize that they have by now thought more deeply about the ethical considerations.

Activity 8: Using a Decision-Making Continuum—Options for Policy Makers
Estimated Time: 10–15 minutes

Display only the top half of the transparency of Master 6.5, and ask students to discuss what they think the terms prohibition, temporary moratorium, incrementalism, restricted pursuit, and no restrictions mean. Display and go over the definitions.

Tell students that they will now consider case examples.

Draw students’ attention to the bottom of Round 2 of the class poster. Pick a case with mostly red stickers, and ask students who put red stickers there what they think the policy recommendation should be for it, and why.

Point out where the red and yellow stickers start to mingle on the poster. Pick a case from there, and ask students to explain why they think these policy recommendations fit best here.

Pick a case where yellow stickers predominate, and ask students to explain which policy recommendations best match that case, and why.

Move up to where the yellow and green stickers start to mingle, and ask students which policy recommendations they think fit best here, and why.

Pick a case where green stickers predominate, and ask students which policy recommendation fits best here, and why.
### Activity 9: Returning to Alba’s Case

**Estimated Time: 20–25 minutes**

<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
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<tbody>
<tr>
<td>1</td>
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<tr>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
<td>Assign the final assessment as homework.</td>
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<tr>
<td>5</td>
<td><strong>Closure:</strong> Review with students that to reach a thoughtful response, people must examine the scientific facts of the case and the relevant ethical considerations.</td>
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<tr>
<td>6</td>
<td><strong>Homework, Final Assessment:</strong> Students make a well-supported policy recommendation for Alba’s case, using the decision-making continuum.</td>
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</tbody>
</table>

**M** Involves copying a master  
**T** Involves making a transparency