LESSON 5:
Case Study Decisions

INTRODUCTION

In this lesson, students read one of three case studies involving animals in research. Students work through a Decision-Making Framework in small groups, in which they identify the ethical question, determine which facts are known or unknown, consider the values of different stakeholder groups, generate possible solutions, and then make and justify a decision about the case. This is a jigsaw exercise, in which students first meet in "like" stakeholder groups to become experts on the values and concerns of that group. Teams are then rearranged so that each new group has students from different stakeholder viewpoints. After sharing the views and values of each stakeholder group with their peers, groups work together to generate options for solutions to the case study. Lastly, students come to individual decisions about the case and write a thorough justification. [**Note:** Some field test teachers suggest transitioning from *Lesson Four* directly to the *Assessment Activity* and using this lesson as a reflective tool for re-visiting the topic at a later date].

KEY CONCEPTS

- A decision-making framework provides a structured format for logical student thought.
- Difficult decisions can be reasoned through in a systematic way, even if the different solutions are not without challenges for diverse stakeholder groups.

LEARNING OBJECTIVES

Students will know:

- A decision about a difficult ethical dilemma can be made by using the following process: identify the ethical question; determine which facts are known or unknown; consider the values of different stakeholder groups; generate possible solutions; and then make and justify a decision about the case.

Students will be able to:

- Reason through a case study using a decision-making framework.
- Apply ethical viewpoints to a case study.
- Create a strong justification for their decision about the case study.

CLASS TIME

One class period of 50 minutes.

MATERIALS

Materials	Quantity
Student Handout 5.1—*Ethical Decision-Making Framework*	1 per student
Student Handout 5.2—*Justify the Answer*	1 per student
Case Studies chosen from the three options: Student Handout 5.3—*Case Study A: Karen's Dilemma* Student Handout 5.4—*Case Study B: Mice and Memory* Student Handout 5.5—*Case Study C: A Trip to the Zoo*	1 per student
Teacher Answer Key 5.1—*Ethical Decision-Making Framework*	1

TEACHER PREPARATION

- Make copies of the Student Handouts.
- Read through the Case Studies and choose which one you will assign to students. Case Studies A and B are appropriate for high school students and those who function at a higher reading level. Case Study C is appropriate for middle school students and those who function at a lower reading level.

PROCEDURE

WARM-UP: CHALK TALK

As students enter the room, have them participate in the Chalk Talk sheets posted around the room. Have a different colored marker than previous days (but still the same for all students) to help distinguish the evolution of thought from day to day.

ACTIVITY ONE: ETHICAL QUESTION, FACTS, AND STAKEHOLDERS

1. Tell students that they will be introduced to a case study involving animals in research in this lesson. They will then use a decision-making framework to help them reason through the case.

2. Have students read the Case Study of choice.

3. Distribute copies of Student Handout 5.1—*Ethical Decision-Making Framework*; one per student. As a class, decide on the ethical question for the Case Study.

4. Give students approximately five minutes to write down the facts from the case and any questions that they have on Student Handout 5.1—*Ethical Decision-Making Framework*.

5. Ask students to brainstorm a list of stakeholders in the case individually.

6. Ask for student volunteers to share the names of stakeholders from their lists. Record the list of the stakeholders on the board.

7. As a class, choose the top four stakeholders that are most affected by the decision and have students list these on Student Handout 5.1—*Ethical Decision-Making Framework*.

ACTIVITY TWO: 'LIKE' STAKEHOLDER GROUPS

8. Divide the class into groups of four and assign one stakeholder to each small group (more than one group can represent the same stakeholder, if needed).

9. Students should consider the values and concerns of that stakeholder group and record them on Student Handout 5.1—*Ethical Decision-Making Framework*. What are their concerns? What do they care about?

10. Each group should also consider duties-based and outcomes-based ethical perspectives from the viewpoint of that stakeholder. Which perspective seems to best fit each stakeholder's view?

11. Allow about five minutes for each stakeholder group to discuss the values and concerns of that stakeholder.

ACTIVITY THREE: 'MIXED' STAKEHOLDER GROUPS

12. Rearrange the class into groups of four, so that each new small group has one representative from each stakeholder set. If there are an odd number of students, two students can represent the same stakeholder in the same group, if needed.

13. Each stakeholder should share, in turn, their values and concerns with the other students in the group until each stakeholder has reported.

14. Students should record this information on Student Handout 5.1—*Ethical Decision-Making Framework*.

15. In this mixed group, have students proceed to the Possible Solutions section on the handout. What are the options for this case? What are the extreme positions? What options occupy the middle ground?

16. Each student should come to a decision. This does not have to be a team consensus, nor does the student have to share his or her decision.

ACTIVITY FOUR: STUDENT-WRITTEN JUSTIFICATION

17. Each student should write a thorough justification for their decision, using the guidelines found on Student Handout 5.2—*Justify the Answer*. Explain to students that a good justification will touch upon all parts of the Decision-Making Framework. Student Handout 5.2—*Justify the Answer* is organized the same way as the framework, beginning with the question and ending with the solutions.

18. If time permits, have students meet in pairs to discuss their justifications. Students can give each other feedback on the strength of their justifications based on Student Handout 5.2—*Justify the Answer*. Students should ***not*** critique each other's position directly, but focus on the strength of the reasoning.

19. Collect the students' written justifications.

CLOSURE

20. Share with students that the decision-making framework and bioethical analysis tools that students have learned over the course of the curriculum will help them as they encounter other bioethical cases. Students may also find them helpful as they consider dilemmas they may encounter personally in the future.

HOMEWORK

- Students can continue to work on their justifications as homework.

TEACHER BACKGROUND

Additional information on ethics can be found in the *Appendix*.

Arguments for using non-human primates in biomedical research

Currently, there are no **non-human primate** substitutes for answering some of the research questions of significant human health importance. Researchers must look for alternatives when proposing their research protocols for approval. Less than one half of one percent of the animals used in research are non-human primates. Every attempt is made to **replace**, **reduce**, and **refine** in order to minimize impacts to primates. Research with primates is subject to guidelines imposed by the **Animal Welfare Act** and the Public Health Service. Researchers are required to show that their research cannot be met without using animals. Additionally many questions can be answered by using "lower" animal species such as zebrafish or mice. Each research institution also maintains an **Institutional Animal Care and Use Committee** which, among other duties, must ensure that protocols avoid or minimize discomfort, pain, and distress. For instance, if a procedure is found to cause any more than slight or fleeting pain, the animal must be anesthetized, sedated, or given other pain relief. There are high standards for animal use, and sometimes there is no other alternative for research whose goal is human health intervention. These are our closest "relatives." Harm to them is minimized.

Many significant advances in human health have been achieved through use of non-human primates in research. Included among these is the culture of the polio virus in monkey kidney, still being carried on today as a source of the virus in the vaccine. Other vaccines, for instance for yellow fever, and disease progressions, for example typhus, have been studied in non-human primates. Non-human primate research has also been used to develop surgical and imaging techniques, such as **MRI**, which have revolutionized the practice of medicine. Some of the above work has been awarded the Nobel Prize. This work has saved lives, extended the lifespan, and improved the quality of life for ***millions*** of humans. These are clear ***benefits*** to humans.

Currently much research around neurological and psychological illnesses, basically brain-based, is conducted in such primates. These conditions include depression, drug addiction, Alzheimer's disease, and Huntington's disease. The study of Huntington's disease is being made possible by the development of a rhesus monkey model with a human gene. The brain similarities among primates make this work possible. Mouse brains with the human gene proved ineffective for such study. Neurological and psychological illnesses are among the more poorly understood conditions experienced by humans and are responsible for much human suffering. Relief of such human suffering is an obvious potential benefit of this research.

Research conducted in animals often leads to benefits for the animal species as well. Vaccines against rabies, distemper, cholera, and other diseases are used on a variety of non-human species. Surgical and imaging techniques are likewise applied to animals. It is not unusual to treat diabetic pets with insulin developed for human use. Non-human animals benefit greatly from research in animals.

Arguments against using non-human primates in biomedical research

Non-human primates express recognizable emotions, establish family groups, exhibit self-awareness, and possess a higher intelligence than other groups of animals. Because of their evolutionary closeness to humans, they are capable of feeling distress when deprived of social interactions. Laboratories sometimes cannot provide the level of social interaction that would alleviate stress, boredom, and anxiety. The goal is to avoid ***harm***, whether it is physical, emotional, or social.

Immediate distress of animals should be avoided out of respect for individual animal lives. Animals with a close evolutionary connection to humans should be treated as individuals, just as humans are. Some say that, because animals cannot speak for themselves, we have an even greater obligation to protect them from harm. Humans volunteer for biomedical research and animals are given no such choice. Often advocates of equal status for animals extend this to a ban on animals as food, companions, or sources of fiber. They state that an animal should be treated with as much respect as a human.

Animal models will not always predict human response to a treatment or drug. There are examples in the literature of treatments found to be effective in animals that were not effective in humans. This is because no other animal is identical to a human in its anatomy and physiology. Even animals engineered to have human genes, such as the mouse model of Huntington's disease, are not always predictive.

Certain research experiments should never be performed on animals or humans because the ***harms*** to the animals and humans are far too high. Included in this category of research is traumatic brain or spinal cord injury, producing burns, and giving lethal doses of radiation. When the ***benefits*** are compared to the harms, the animals bear most of the harms while the humans receive all or most of the benefits.

GLOSSARY

Animal Welfare Act of 1966 (AWA): A federal law that governs the care, handling, treatment, and transportation of animals in situations that include: laboratories, animal dealers and breeders, exhibitors, and transporters of animals. The law sets out minimum standards for housing, ventilation, lighting, shelter, and veterinary care.

Biochemical Pathways: A series of chemical reactions that occur within a cell and are catalyzed by one or more enzymes.

Cytokines: Protein molecules that are secreted by the nervous system and immune system. These signaling molecules play a role in the communication between cells.

Dementia: A loss of brain function that may affect thinking, language, memory, and behavior.

Duties-based Ethical Theory: An ethical theory that focuses on the ***act*** itself (as opposed to the consequences of that act), and asks the question, "Would it be acceptable if everyone else were to act in this way? Is the ***action***, no matter the consequences, ***right*** or **wrong**?" This theory can also be thought of as, "The ends do ***not*** justify the means."

Embryo: An organism at its earliest stages of development, after fertilization of the egg and first cell division. In humans, an embryo is the first eight weeks after fertilization, after which the developing organism is called a fetus.

Free Radicals: Atoms or groups of atoms with an unpaired number of electrons. These highly reactive atoms can damage DNA.

Humane: Treating animals with respect and care.

Institutional Animal Care and Use Committee (IACUC): Federal law states that any organization that uses laboratory animals for research or instruction must have an IACUC that oversees the care and use of laboratory animals.

Magnetic Resonance Imaging: Also known as a MRI, this imaging technique is used to look at structures inside the body.

Mitochondrial Function: The mitochondria are organelles that generate ATP, the cell's source of energy. The mitochondria also perform functions that include controlling cell growth and death, signaling, and cellular differentiation.

Molecular Genetics: A specialty within the field of biology that studies the structure and function of genes at the molecular level.

Motor Neurons: Neurons (nerve cells) in the central nervous system that help control muscle movement.

Neurological Diseases: Disorders that affect the brain, spinal cord, and nerves.

Non-human Primate: Member of the order Primates, not including humans.

Outcomes-based Ethical Theory: An ethical theory that focuses on the ***consequence*** of an act, and asks the question, "What are the consequences of the action?" In getting caught, the bad outcome (e.g., getting in trouble, losing points on the assignment, or being seen as dishonest) would outweigh any benefits from the cheating. This theory can also be thought of as, "The ends ***justify*** the means."

Primate: Member of the order Primates, which includes anthropoids (monkeys and apes—which include humans) and prosimians (galagos, lemurs, lorises, and tarsiers).

Reduction: One of the 3 Rs of animal research proposed by Russell and Burch. Reduction means using the fewest number of animals possible in a research project to gain statistically significant results.

Refinement: One of the 3 Rs of animal research proposed by Russell and Burch. Refinement means using any technique or procedure that decreases the suffering, or enriches the life of, an animal used in research.

Replacement: One of the 3 Rs of animal research proposed by Russell and Burch. Replacement means replacing conscious, living vertebrates with cell or tissue cultures, computer models, and/or less developed animal species.

Stakeholder: Any person, institution, or entity that is interested in, invested in, or will be affected by the outcome of a decision.

Transgenic Organism: A living organism in which genes, or gene regulatory regions, have been added, removed, or modified. The change in DNA will cause the organism to exhibit a new property (immune system change, genetic disorder, etc.) which can be passed to its offspring.

CREDIT

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Yerkes National Primate Research Center. http://www.yerkes.emory.edu/

STUDENT HANDOUT 5.1

Ethical Decision-Making Framework

Name_____ Date_____ Period_____

Ethical Question:		
1. Relevant facts (known)	2. Questions that remain (unknown, need to know)	
3. Stakeholders (people and/or entities affected by the decision)	4. Concerns/values of each stakeholder	5. Ethical viewpoints
_____ →	_____ →	_____
_____ →	_____ →	_____
_____ →	_____ →	_____
_____ →	_____ →	_____
6. Possible decisions/options a. b. c.		
7. Decision and justification:		

HANDOUT

HANDOUT

STUDENT HANDOUT 5.2

Justify the Answer

Name_____ Date_____ Period_____

A strong justification should have the following components:

✔	A good justification includes:	Which means...
☐	A DECISION	A position (claim) has been clearly stated. The decision relates directly to the ethical question.
☐	FACTS	The facts and science content can be confirmed or refuted regardless of personal or cultural views. This can be used as evidence to support the claim.
☐	ETHICAL CONSIDERATIONS	Ethical considerations ***may*** include duties-based and outcomes-based ethical perspectives. This can be used as evidence to support the claim.
☐	STAKEHOLDER VIEWS	There are a variety of views and interests in the decision and more than one individual or group will be affected by the outcome.
☐	ALTERNATE OPTIONS and REBUTTALS	No one decision will satisfy all parties. A thorough justification considers strengths and weaknesses of various positions.
☐	REASONING and LOGIC	A logical explanation that connects the evidence to the claim is provided.

For our purposes, the justification for the decision is more important than the position on the decision.

HANDOUT

HANDOUT

STUDENT HANDOUT 5.3

Case Study A: Karen's Dilemma

Name_____ Date_____ Period_____

Twenty-seven-year old Karen Goodman is a rising star in **molecular genetics** having just completed her PhD at the University of Washington. Her research involved the production and use of **transgenic** mice—mice that have had their genetic makeup altered by the introduction of genes from another organism. In her case, a gene for Amyotrophic Lateral Sclerosis (ALS), also known as Lou Gehrig's Disease, was introduced into the mice and then she was able to study a protein produced by this gene that initiated the onset of the ALS symptoms. Her research will be published in the international journal *Cell Biology* next month.

Karen has been offered a four year contract to work at one of the largest primate research centers in the U.S., the Adams/Hamper labs of Portland, Oregon. Adams/Hamper does both behavioral and physiological research on several species of monkeys in hopes of finding **biochemical pathways** for several human diseases. From this information they hope to develop drugs and other forms of intervention to cure or reduce the effect of the diseases. They are currently doing work on HIV, Huntington's disease, cystic fibrosis, autism, Tay-Sachs disease, ALS, and others. Much of their work has involved the replication and verification of work done in other labs using transgenic mice or other non-primate animal models. However, Adams/Hamper is using **non-human primates** exclusively because of their greater similarity to humans than other animal models. The next step for successful development of treatments would be to try them on human subjects. Karen is particularly impressed with their functional **Magnetic Resonance Imaging** facility, perhaps the best on the West Coast, which can track biochemical changes in the brain. This imagery has helped greatly in tracking the changes in brain biochemistry as diseases progress, as well as changes brought about by the introduction of drugs.

Karen's job, if she accepts it, would be to develop a line of transgenic **monkeys** (*rhesus macaques*) that contain the human gene for Huntington's disease. The rhesus monkeys Karen would be working with are non-human primates, but are not in the same category as **apes** which include orangutans, chimpanzees, and gorillas.

Transgenic rhesus monkeys with the human Huntington's gene have already been produced. However, in breeding, the gene is lost in the second generation. Karen's expertise would be very valuable in correcting this problem so that a ready population of monkeys with the Huntington's disease gene would be available for research.

Adams/Hamper currently does not seem to have a specific design for experiments that would be conducted using the transgenic Huntington's monkeys once they are developed. There is some indication that the Huntington's protein, which is produced by animals with the disease, somehow stimulates the immune system to cause an overproduction of **cytokines** in the brain which brings on Huntington's symptoms. There also is an indication that **mitochondrial function** is modified resulting in the production of toxic **free radicals**. All of these findings have been studied using Huntington's transgenic mice. Similar processes seem to be occurring in transgenic ALS mice. However, these studies have not been verified in non-human primates and Adams/Hamper has no specific experiments designed.

Huntington's is a terrible disease resulting in the gradual degeneration of the nervous system. It slowly incapacitates the **motor neurons** resulting in uncontrolled movements. It progresses to loss in intellectual capacity and frequent emotional outbursts. Eventually it shuts down major body systems until death occurs.

As a company, Adams/Hamper has the advantage of having several scientists working collaboratively on a number of neurological diseases and excellent equipment and technical support staff. The culture of the organization is to share results and insights in hopes that research in one area could introduce ideas and techniques that might be used in another area. The company is publicly traded and has a strong financial footing with a board that sees research into new treatment as the key to its future.

Karen is concerned and has reservations about her involvement in introducing Huntington's to primates. She sees herself as the agent that would be introducing a terrible disease to a monkey population. She wonders if the monkeys' high level of awareness and ability to think in terms of the future and the past make introducing a disease like Huntington's different from introducing it to the non-primate animal models she has worked with in the past. She also can't see how pain and anxiety can be effectively addressed in the test animals.

HANDOUT

Adams/Hamper has agreed to follow strict international guidelines for the use and care of non-human primates in research. These rules are designed to minimize pain and distress as well as promote the welfare of the animals. Because of the highly developed social structure and intelligence of primates, this care involves special training by handlers and researchers and specific procedures such as:

- Housing animals in socially harmonious groups.
- Providing a mentally stimulating environment.
- Systematic positive human contact.
- Weaning of animals at an appropriate age.

Adams/Hamper has been fined twice by the U.S. Department of Agriculture for mistreating animal subjects and not following research protocols that were agreed to in advance.

Karen is also concerned about some recent trends to move away from research using non-human primates in some other countries. The Netherlands has banned all research on chimpanzees. Spain is in the process of granting near human rights to the great apes such as chimpanzees, gorillas, and orangutans. They would ban all research on these great ape species, though not monkey species like the rhesus macaque she would be studying at Adams/Hamper.

Should Karen accept the job at Adams/Hamper?

Contributed by Rod Mitchell.

GLOSSARY

Ape: Members of the superfamily *Hominoidea* that includes gorillas, chimpanzees, orangutans, and siamangs. Their use in biomedical research is extremely rare and banned in some countries.

Biochemical Pathways: A series of chemical reactions that occur within a cell and are catalyzed by one or more enzymes.

Cytokines: Protein molecules that are secreted by the nervous system and immune system. These signaling molecules play a role in communication between cells.

Free Radicals: Atoms or groups of atoms with an unpaired number of electrons. These highly reactive atoms can damage DNA.

Magnetic Resonance Imaging: Also known as a MRI, this imaging technique is used to look at structures inside the body.

Mitochondrial Function: The mitochondria are organelles that generate ATP, the cell's source of energy. The mitochondria also perform functions that include controlling cell growth and death, signaling, and cellular differentiation.

Molecular Genetics: A specialty within the field of biology that studies the structure and function of genes at the molecular level.

Monkey: Non-human, non-ape primates, including rhesus macaques, baboons, and marmosets. Rhesus monkeys are the most common type of non-human primate used in biomedical research.

Motor Neurons: Neurons (nerve cells) in the central nervous system that help control muscle movement.

Non-human Primate: Member of the order Primates, not including humans.

Primate: Member of the order Primates, which includes anthropoids (monkeys and apes—which include humans) and prosimians (galagos, lemurs, lorises, and tarsiers).

Transgenic Organism: A living organism in which genes, or gene regulatory regions, have been added, removed, or modified. The change in DNA will cause the organism to exhibit a new property (immune system change, genetic disorder, etc.) which can be passed to its offspring.

HANDOUT

STUDENT HANDOUT 5.4

Case Study B: Mice and Memory

Name_____ Date_____ Period_____

Twenty-seven-year-old Karenna Goodman is a rising star in molecular genetics having just completed her PhD at Pennsylvania State University. Her research involved the production and use of **transgenic** yeast—yeast that have had their genetic makeup altered by the introduction of genes from another organism. In her work, Karenna was able to insert a gene for Amyotrophic Lateral Sclerosis (ALS) – Lou Gehrig's Disease – into the yeast and then study a protein produced by this gene. This protein is thought to be instrumental in the onset of the ALS symptoms. Her research will be published in the international journal *Cell Biology* next month.

Karenna has been offered a position at a thriving research lab at the University of Washington, the Adams/Hamper lab. The Adams/Hamper lab does research on transgenic mice in hopes of finding **biochemical pathways** for several human diseases. From this information they hope eventually to develop drugs and other forms of intervention to cure or reduce the effect of the diseases. They are currently doing work on HIV, Huntington's disease, cystic fibrosis, autism, Tay-Sachs disease, ALS, and others.

Karenna's work will involve working with transgenic mice that contain the human gene for Huntington's disease. Huntington's is a terrible disease resulting in the gradual degeneration of the nervous system. It slowly incapacitates the **motor neurons** resulting in uncontrolled movements. It progresses to loss in intellectual capacity and frequent emotional outbursts. Eventually it shuts down major body systems until death occurs. Studies have shown that the Huntington's protein, which is produced by animals with the disease, may affect both the immune system and the function of the **mitochondria**. However, these studies have not been verified in **non-human primates**. Because of their greater similarity to humans than other animal models, Karenna's department is also working to develop a line of transgenic rhesus monkeys that contain the human gene for Huntington's disease. If the work in mice and non-human primates produces successful treatments, the next step would be to try them on human subjects. The Adams/Hamper lab group works collaboratively with a number of other groups studying **neurological diseases**. They share results and insights in hopes that ideas and techniques developed in one area might be used in another.

During her first week in the lab, Karenna is surprised to see a group of animal rights activists protesting animal research outside the university entrance. The posters they carry are graphic and disturbing. Karenna has always felt comfortable about her work with transgenic mice, but knows that her research, if successful, will lead to the use of non-human primates in research. She believes that the university follows strict international guidelines for the use and care of non-human primates in research—rules designed to minimize pain and distress as well as promote the welfare of the animals. But where did the activists get those pictures? Karenna also knows that, for many animal activists, there are ***no*** acceptable research animals. Karenna remembers reading about a researcher in California whose house was firebombed by animal activists—and that researcher worked with fruit flies.

Karenna marches past the animal rights activists to enter her building and considers her situation. They might consider her work to be unethical, but she does not. ***Is it?***

Modified from a case study contributed by Rod Mitchell.

HANDOUT

GLOSSARY

Biochemical Pathways: A series of chemical reactions that occur within a cell and are catalyzed by one or more enzymes.

Mitochondria: The mitochondria are organelles that generate ATP, the cell's source of energy. The mitochondria also perform functions that include controlling cell growth and death, signaling, and cellular differentiation.

Molecular Genetics: A specialty within the field of biology that studies the structure and function of genes at the molecular level.

Motor Neurons: Neurons (nerve cells) in the central nervous system that help control muscle movement.

Neurological Diseases: Disorders that affect the brain, spinal cord, and nerves.

Non-human Primate: Member of the order Primates, not including humans.

Primate: Member of the order Primates, which includes anthropoids (monkeys and apes—which include humans) and prosimians (galagos, lemurs, lorises, and tarsiers).

Transgenic Organism: A living organism in which genes, or gene regulatory regions, have been added, removed, or modified. The change in DNA will cause the organism to exhibit a new property (immune system change, genetic disorder, etc.) which can be passed to its offspring.

STUDENT HANDOUT 5.5

Case Study C: A Trip to the Zoo

Name_____ Date_____ Period_____

As Jane and Amanda settled into their seats for the two and a half hour bus trip back to their high school, they heard their teacher ask for the observation sheets they had completed that day. In the large enclosure of the Primate House at Franklin Park Zoo, the two students had seen gorillas for the first time, and sometimes it was up close and personal.

"I'll never forget how that gorilla, Kit, ran at the window when Bobby made eye contact with him," Jane said of the large male gorilla.

"Yeah," said Amanda, "I thought he was going to break the window when he pounded it so hard. Bobby's big for a sophomore, but he sure jumped when the gorilla did that. Even though the glass between them is very thick, you could tell he was surprised."

"Speaking of surprised! How about when Kiki brought Kumani up to the viewing window from their side?" Jane added. "It was almost like she was inviting that toddler on our side of the window to play with Kumani. And then they did play, sort of. That made me stop and think."

"About what?" asked Amanda.

"About mothers and daughters and families and stuff. You know, gorillas…and humans, too," answered her friend.

Jane looked for a response, but instead Amanda turned thoughtful as if she was having a hard time choosing her words. Jane waited and then realized that her friend needed a few moments to herself. As Jane switched her attention to the movie starting up on the bus monitors, Amanda continued thinking about families, gorillas, humans, and new connections.

Amanda's mother was spending more and more of her time with grandma Betty. Gram had Huntington's disease, a disease of the nervous system that does not usually show up until middle age. Amanda had gotten very interested in this condition since Gram was diagnosed four years ago. She knew it would get worse every year and that Gram's jerky body movements and the strange facial expressions she often made would progress to the point that she would no longer be able to move around or want to go out in public. The disease that had already robbed her of her independence would eventually confine her to bed and lead to **dementia**. Huntington's would slowly kill Gram in another five to fifteen years.

She had tried not to think of this today, but the gorilla interactions had brought it back. They had families, too. In so many ways they exhibited so-called human characteristics. They were big and hairy and didn't talk, but they had many recognizable behaviors. She knew from biology class that gorillas were genetically related to humans. What she had seen today had made that real.

Uneasiness grew inside Amanda as she thought about Huntington's disease and the prospects for helping her Gram. She also knew that other members of her family, including her mom and Amanda herself, were at increased risk of developing the condition later in their lives. Surfing the net she had come across a recent advance in Huntington research. Scientists had developed a primate model of Huntington's disease by genetically incorporating the Huntington's disease gene into rhesus monkey **embryos**. Rhesus **monkeys** are close cousins to the gorilla **apes** Amanda had just seen in the zoo. Now they had an animal, relatively close to humans in evolutionary terms, that could help them study this devastating disease.

All the biology students had been assigned to create a thesis statement about **non-human primates**, drawing on their classroom and zoo experiences. Before today she had believed she would argue for the use of non-human primates in researching **neurological diseases**. Now she was not so sure.

She knew where the uneasiness had come from. She loved Gram and her suffering was real. It would get worse consistently, taking away her mind and her body functions. And this would take five to fifteen years. It was an awful disease. She wanted this animal model to be used to help develop basic knowledge about Huntington's disease and then therapies for the disease. But what she had seen today concerned her. Because of their evolutionary closeness, non-human primates shared many physical and behavioral characteristics. The same thing that made them excellent research models for studying disease worried her. The similarities she had seen today reminded her of human qualities. Should such evolutionarily close animals be the subjects of research?

HANDOUT

Back at home Amanda found additional information about non-human primate research. Rhesus monkeys are the most widely used and most significant non-human primate model for biomedical research, sharing 93% of their genes with humans. They are considered the best animal model for investigations of AIDS, neurological disorders including addiction, vision research, aging, obesity, cardiovascular diseases, diabetes, and drug studies. The females even have a 28 day menstrual cycle, making them models for human birth control and other reproductive research. Their use has already led to the development of the polio vaccine, an understanding of blood types, and linkages between hormone levels and depression.

Monkeys and other non-human primates feel pain and are social animals like humans. This has often led people to object to their research uses. Many grant a right not to suffer, be harmed, and/or be killed to all animals. This view would essentially require us ***not*** to use animals in research at all. Some other opponents of animal research would extend these prohibitions only to certain groups of animals or would make a few exceptions, for instance where the benefit would also be given to the species studied. It has also been argued that animals should be considered individuals, just as we do people. This would give them a moral value we must respect, preventing their use in research.

Amanda further found that the **Animal Welfare Act** requires research facilities to treat animals responsibly and **humanely**. They must establish **Institutional Animal Care and Use Committees** (IACUCs) to oversee the research. Often called the 3 Rs, their approaches involve **reduction** of the number animals to the minimum needed, **refinement** of procedures to minimize pain or distress, and **replacement** by alternative methods of study, if appropriate. The IACUCs consider alternatives wherever possible. Still, to some, any pain or distress in a research animal is unacceptable.

What should Amanda write about? Should she defend the use of non-human primates in biomedical research, expressing her hopes for therapies to help humans such as her Gram? Or should she write in opposition to it, considering the experiences she had today? Both views could be supported by current understandings of genetics and natural history.

Is it ethical to use non-human primates in biomedical research?

Contributed by Karen O'Neil, Pioneer Valley Regional School.

HANDOUT

GLOSSARY

Animal Welfare Act of 1966 (AWA): A federal law that governs the care, handling, treatment, and transportation of animals in situations that include: laboratories, animal dealers and breeders, exhibitors, and transporters of animals. The law sets out minimum standards for housing, ventilation, lighting, shelter, and veterinary care.

Ape: Members of the superfamily Hominoidea that includes gorillas, chimpanzees, orangutans, and siamangs. Their use in biomedical research is extremely rare and banned in some countries.

Dementia: A loss of brain function that may affect thinking, language, memory, and behavior.

Embryo: An organism at its earliest stages of development, after fertilization of the egg and first cell division. In humans, an embryo is the first eight weeks after fertilization, after which the developing organism is called a fetus.

Humane: Treating animals with respect and care.

Institutional Animal Care and Use Committee (IACUC): Federal law states that any organization that uses laboratory animals for research or instruction must have an IACUC that oversees the care and use of laboratory animals.

Monkey: Non-human, non-ape primates, including rhesus macaques, baboons, and marmosets. Rhesus monkeys are the most common type of non-human primate used in biomedical research.

Neurological Diseases: Disorders that affect the brain, spinal cord, and nerves.

Non-human Primate: Member of the order Primates, not including humans.

Primates: Member of the order Primates, which includes anthropoids (monkeys and apes—which include humans) and prosimians (galagos, lemurs, lorises, and tarsiers).

Reduction: One of the 3 Rs of animal research proposed by Russell and Burch. Reduction means using the fewest number of animals possible in a research project to gain statistically significant results.

Refinement: One of the 3 Rs of animal research proposed by Russell and Burch. Refinement means using any technique or procedure that decreases the suffering, or enriches the life of, an animal used in research.

Replacement: One of the 3 Rs of animal research proposed by Russell and Burch. Replacement means replacing conscious, living vertebrates with cell or tissue cultures, computer models, and/or less developed animal species.

HANDOUT

HANDOUT

TEACHER ANSWER KEY 5.1

Ethical Decision-Making Framework

1. Relevant facts (known)

Student responses should provide a list of known facts and science content that can be confirmed or refuted regardless of personal or cultural views.

2. Questions that remain (unknown, need to know)

Student responses should include a list of questions that demonstrate that they have thought about what they still need to know to form their decision.

3. & 4. Stakeholders & concerns/values of each stakeholder

Student responses should list the names of stakeholders, the stakeholders' views on the subject, and the concerns and/or values that group brings forward. Student responses should show that there is a variety of views and interests in the decision and that more than one individual or group will be affected by the outcome.

5. Ethical viewpoints

Student responses should link the stakeholders' views to ethical considerations, including, but not limited to, duties-based and outcomes-based ethical perspectives.

6. Possible decisions/options

Student responses should include more than one possible decision, since no one decision will satisfy all parties. Students should demonstrate a consideration of the strengths and weaknesses of various positions.

7. Decision and justification

A position should be clearly stated and the decision should directly relate to the ethical question. For additional scoring guidance, refer to the scoring rubric below.

RESOURCE

Scoring Rubric for Student Justifications

Dimension	Exemplary (5 points)	Proficient (3 Points)	Partially Proficient (1 Point)	Developing (0 Points)
What is your ***decision***? (A position that relates directly to the ethical question has been clearly stated.)				
Decision	Student's choice of best option is clearly stated. The decision relates directly to the ethical question. Student shows thoughtful consideration and organized thinking.	The student's choice of best option is clearly stated, but the option may not relate directly to the ethical question. Student shows clear thinking.	Student does not clearly state an option or does not state what should be done. Student does not give any reasons to support his/her decision.	Student states an option that is not one of the options for the case or student response shows no understanding of the situation or the question being asked.
What ***facts*** support your decision? Is there information missing that could be used to make a better decision? (The facts and science content can be confirmed or refuted regardless of personal or cultural views.)				
Facts	The justification ***uses the relevant scientific reasons*** to support student's answer to the ethical question. Student demonstrates a solid understanding of the context in which the case occurs, including a thoughtful description of important missing information. Student shows logical, organized thinking. Both facts supporting the decision and missing information are presented at levels exceeding standard (as described above).	The main relevant facts are identified. All scientific concepts are correctly presented. Student shows clear thinking. Student references information missing from the case that would influence decision-making. Both facts supporting the decision and missing information are presented at levels meeting standard (as described above).	Factual information relevant to the case is described but some key facts may be missing and some irrelevant information may also be included. Student may not have mentioned information missing from the case that would influence decision-making. Student presents only facts or missing information.	Factual information relevant to the case is incompletely described or is missing. Irrelevant information may be included and student demonstrates some confusion.
Which ***stakeholders*** will be impacted by the decision and how will they be impacted? (There are a variety of views and interests in the decision, and more than one individual or group will be affected by the outcome.)				
Stakeholder Views	Three or more stakeholders, the ways in which they are impacted, and their values, interests, and/or concerns are identified OR four or more stakeholders and the ways in which they are impacted are identified.	Three stakeholders and the ways in which they are impacted are identified OR four stakeholders are identified without mention of the impacts on them.	Two stakeholders and the ways in which they are impacted are identified OR three stakeholders are identified without mention of the impacts on them.	Only one stakeholder and the way in which this stakeholder is impacted is identified OR two stakeholders are identified without mention of the impacts on them.

Scoring Rubric for Student Justifications – continued

Dimension	Exemplary (5 points)	Proficient (3 Points)	Partially Proficient (1 Point)	Developing (0 Points)
What are the main ***ethical considerations***? (Ethical considerations may include duties-based and outcomes-based ethical perspectives.)				
Ethical Considerations	The student ***evaluates the case in depth using one or more ethical considerations.*** The student shows exceptional understanding of how one or more ethical considerations relates to the case. The student's decision is supported by the thorough, thoughtful application of the consideration(s) of the case. The student demonstrates organized thinking, and his/her conclusions flow logically from premises.	The student demonstrates an understanding of the ethical consideration(s) related to the case. The student provides clear explanation of how ethical considerations support his/her decision.	The student demonstrates a general awareness of ethical considerations and how they relate to the case, but may not articulate the relationship clearly or provide enough explanation. The student demonstrates mostly clear and organized thinking, but portions of the answer may be unclear, disorganized, or incomplete.	The student lacks an awareness of ethical principles or does not properly relate them to the case. The student demonstrates some confused or disorganized thinking. Student response does not include ethical considerations (i.e., legal considerations).
What are the strengths and weaknesses of ***alternate solutions?*** (No one decision will satisfy all parties. A thorough justification considers various positions.)				
Alternate Solutions	Thorough analysis of the alternate solutions that includes multiple strengths and weaknesses and/or multiple alternate solutions. The writing is clear and organized.	Presents both the strengths and the weaknesses of the alternate solution(s).	Only discusses the strengths or the weaknesses of the alternate solution or contains either misconceptions or unrealistic strengths or weaknesses.	No alternate solutions are discussed, or presents strengths and/or weaknesses for solution, not alternate solutions, or presents unrealistic alternatives.