



Are Animals One Of Us?:

Thinking Critically About the Ethics of Animal Use in Biomedical Research

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Overview

Non-human animals are obviously living, breathing, complex beings much like we are, but are at the same time different from us in many ways. Some of the crucial questions with regard to how animals should be treated are: Are animals one of us? If so, are they deserving of the same rights and respect as humans? If not, how and in what ways are they different from us? Are they significantly different from us in ways that should allow us to treat them as...well...animals?

The unit will begin with a short case about the ban on the sale of live lobsters. This case will lead to a discussion about the ability of animals to experience pain and whether and why it is ever justifiable to inflict discomfort or pain on animals. To that end, students will explore and compare various ways animals are used including the use of animals in biomedical research.

Because of the difficulties of using pain as the main (and only) principle for our treatment of animals, students will consider whether animals have a moral status or value that is independent of their ability to experience pain or suffering. And if so: is their value only extrinsic, i.e. are they only valuable in relation to their usefulness? Or do animals have intrinsic value that determines the way they should be treated? Students will explore and discuss positions on this issue from a variety of religious and philosophical sources.

Next, students will discuss the use of animals in biomedical research. They will first be introduced to statistics about the use of animals followed by a discussion of four different views on the issue held by contemporary ethicists. In the course of this discussion, students will analyze current ethical arguments for and against animal use in research.

The unit will conclude with a discussion of the extent and limitations of current rules and regulations for the treatment of animals in biomedical research, and the role of Institutional Animal Care and Use Committees (IACUC) in evaluating research projects involving animals. Students will play the role of members of an IACUC and discuss the difficulties and challenges of the process of implementing current regulations.

Learning Outcomes

- ✦ To understand the ethical implications of killing or inflicting pain on animals in general, and in bio-medical research in particular
- ✦ To become familiar with philosophical and ethical arguments concerning the value, rights, or welfare of animals
- ✦ To become familiar with the current laws and regulations for the use of animals in research
- ✦ To become familiar with cases that prompted a debate and establishment of binding regulations of the use of animals in research
- ✦ To be aware of possible shortcomings and challenges of current regulations and consider changes
- ✦ To understand the significance of possible alternatives to the use of animals in biomedical research

Standards Alignment

PA Standards (See also Appendix)	
Reading, Writing, Speaking and Listening (Grade 11):	1.1., 1.2., 1.6., 1.8.
Science and Technology, Environment and Ecology (Grade 12):	3.2., 3.6., 3.8.
Civics and Government (Grade 12):	5.1., 5.2., 5.3.
History (Grade 12):	8.1., 8.3.
Health, Safety and Physical Education (Grade 12):	10.1.
Common Core State Standards	Writing Standards for Literacy in History/ Social Studies, Science, and Technical Subjects 6-12

Procedures & Activities

This unit uses a student-centered and interactive approach to teaching. Activities are designed to allow for a maximum degree of student participation and collaboration. Each activity is marked as an individual-, partner-, or group activity, or as a teacher-directed class discussion.

The following icons are used to designate the different types of activities:



- Individual Activity



- Partner Activity



- Group Activity



- Teacher-Directed Class Discussion

1. Introduction

A note on terminology: Emphasize to students that human beings are animals. But for purposes of this lesson the term 'animals' will be used to refer specifically to non-human animals.



1. Pre-Existing knowledge questions: Students will answer the following questions.

- ✦ Have you ever conducted experiments in science class using living animals?
- ✦ Have you ever dissected an animal in science class?
- ✦ Do you own a pet? Do you think it/he/she experiences pain in the same way we do?
- ✦ What do you think is the main difference between animals and humans?
- ✦ Do animals have emotions?
- ✦ Do you think animals do or should have rights (the way humans do)?

2. Animal Use, Cases and Controversies

Should we ban the sale of live lobsters?



1.  Look at the picture above. Write down the first 3-5 words that come to mind (e.g. hot, yummy, yuck!, pain, Maine, Red Lobster, cruel, etc.)
2.  Share and compare your notes with a partner. How did your response differ from that of your partner? Divide words into two categories: positive, negative. Which of the two categories has more items? What prompted your negative reactions? (e.g. disgust, pity, compassion, hunger, etc.)
3.  Mention to the class that the Whole Foods supermarket chain stopped selling live lobsters in 2006. Any idea why?

Share the following documents with your students:

PETA: "Lobsters are known to live more than 145 years in the ocean and can travel more than 100 miles a year. Lobsters have sophisticated nervous systems and are capable of experiencing pain and suffering. In their natural ocean homes, they have been observed walking claw-in-claw, the old leading the young."

John Mackey, Whole Foods' co-founder and chief executive: *We place as much emphasis on the importance of humane treatment and quality of life for all animals as we do on the expectations for quality and flavor.*

Bruce Friedrich, a spokesman for PETA: *The ways that lobsters are treated would warrant felony cruelty to animals charges if they were dogs or cats.*

Tony Blankley, Washington Times Op-ed, June 21, 2006: *Invertebrates, such as lobsters and snails (which are also delicious) conveniently (for those of us who love to eat lobsters and snails and also feel sympathy for animals) have simple nervous systems made up of chain ganglia -- groups of neurons connected by nerve fibers. According to Professor Craig W. Stevens of Oklahoma State University in Tulsa, the chain ganglia network is so simple it doesn't require a brain.*

What are the arguments in these quotes for and against the sale and use of live lobsters?

PRO	CONTRA
- Lobsters have simple nervous systems that don't require a brain	- Lobsters have sophisticated nervous systems and are capable of experiencing pain and suffering. - The treatment of lobsters would warrant felony [charges for] cruelty to animals if they were dogs or cats.

Discussion questions:

- * How can the obvious contradiction between the descriptions of the nervous system of lobsters be resolved? (What are the definitions of "simple" and "complex" in these statements?)
- * Are there ways to determine whether animals can experience pain based on the make-up and structure of their brains?
- * Is it possible (at all) to determine with certainty whether animals (human or nonhuman) can experience pain?
- * If so, should our knowledge about pain influence the way we treat animals?
- * One of the arguments above compares the treatment of lobsters to that of dogs and cats. Is this argument

convincing? Why or why not?

- * If the lobster in the picture above were instead a cat or a chimpanzee would that make you feel differently? How and why? (See pictures below)



- 4. Let's assume the ability to experience pain could and should be used in determining the way we treat animals. Where should we draw the line? Look at the following list of animals. Which of these animals do you think experiences pain, which doesn't, and for which of them are you not sure.

chimpanzee clam elephant octopus mouse
dog your pet goldfish cow corals y
dolphin canary shark horse rat spider

EXPERIENCES PAIN	DOESN'T EXPERIENCE PAIN	NOT SURE

- 5. Compare your findings with a partner. What criteria, principles or assumptions determined your decision (e.g. animals' behavior indicates pain, assumptions about nervous system, intuition, degree of similarity to humans, etc.).
- 6. Collect and discuss students' findings. What are their decisions based on? Record and organize principles used on the board, e.g. Behavior: behavior indicating pain, compared to human reactions to pain; Status: Based on which class of animals they belong to, e.g. mammals, insects, fish, or: vertebrates/invertebrates; Cognition: Assumed level of intelligence, based on structure/make-up of brain/nervous system; Intuition, etc.

Questions for discussion:

- * Based on what we know so far, do you believe that it is possible, in principle, to determine whether or not an animal experiences pain, and to what degree?

- Should the ability to experience pain be our main criterion in determining how we should treat animals?
- If so, is it always wrong to inflict suffering on those animals that deliberately experience pain?

Which uses of animals are justified, and which aren't?

7.  Let's take a step back for a moment and look at the many different ways in which animals are used in our society. What are some examples? (E.g. sports, food, pets, research, agriculture, etc.)

8.  Group-work: Students will get into small groups of 3-5 students. Each group will do research on one of the following areas in which animals are used by humans. Based on our previous discussions about pain and the status of animals, in general: Is the use of animals in the area you researched 1) always justified, 2) never justified, or 3) sometimes justified. Provide reasons for your decision.

Categories:

1. Raising and killing animals to serve as food for humans
2. Killing animals that are a direct threat/nuisance to humans (e.g. sharks, mosquitoes, rats, deer in urban areas, etc.)
3. Using animals in research that could help protect humans from disease, pain, suffering, premature death, etc.
4. Using animals to make the lives of humans more pleasurable (fur, perfume, beauty products)
5. Using animals in sports/entertainment (horseback riding, hunting, dog-, bull-, cock-fighting, circus, etc.)
6. Using animals to work or perform tasks for humans (agriculture, seeing-eye dogs, police dogs, dogs in the military, etc.)

9.  Groups will present their findings. Identify (and record) reasons/principles that were used to decide which of these uses of animals are justified or not (e.g. degree of benefit to humans, necessity, nature, suffering, etc.)

Further questions for discussions:

- If it is sometimes ok to kill or inflict some level of discomfort or pain on animals, what justifies such treatment of animals in those cases?
- If pain is not the main criterion, are there other criteria that could be used to determine how we should treat animals?
- Should we distinguish between different degrees (more or less justifiable amounts) of discomfort, pain, or suffering?

- Finally, does our treatment of animals (and our justification for inflicting pain and suffering) depend on their purpose and benefit for us?
- Do animals have rights? If so, what are they?
- What is their moral status, if any?
- Do animals have value, and if so, what is that value?

3. Moral Status & Questions of Value

Introduction: Do animals have a moral status or value?

As we have seen in the first segment of this unit, one approach to the question of how animals should (and, more importantly, shouldn't) be treated, is to look at whether animals experience pain as we do. Now, as we have also seen, the problem with relying on pain as the only criterion is that it may not be easy (or possible) to determine whether animals experience pain at all, and to what degree.

In addition, it has become clear in the second section of this unit, that there may be cases in which we may consider it ethically permissible to inflict at least some level of discomfort, pain, or even death on (some) animals.

Maybe there is another (less messy) way to determine how we should treat animals? Namely by determining what the value, or moral status of animals is, which may then allow us to formulate principles that could be used as a guide to our treatment of animals.

When we talk about something having "value," what exactly do we mean? First of all, we may distinguish between intrinsic and extrinsic value.

Intrinsic Vs. Extrinsic Value

1.  Ask students what they think the difference between intrinsic and extrinsic value could be?

Intrinsic value and goods:

- Something just is valuable; non-derivatively good
- The value is an internal property of something, defines its existence.
- Something has intrinsic value if it is valuable "in itself," or "for its own sake," or "as such," or "in its own right"
- It's an "end in itself"

Extrinsic value:

- Instrumental goods
- good for something, i.e. "means to an end"

2.  Based on the definition above, students should decide on at least three things they believe have “intrinsic” value (e.g. democracy, freedom, liberty, life, beauty, art, the earth/environment, nature, etc.).

3.  Collect and discuss students’ findings. What gives these items “intrinsic” value? I.e. what makes them good “as such”, or “in themselves”? (E.g. the line in the declaration of independence: “We hold these truths to be self-evident ...” shows the need for basic principles that we can all agree upon and that cannot, or should not, further be questioned).

In what way can we say that humans have intrinsic value that is not limited to being used for some purpose, i.e. that a human is an end-in-itself, rather than a means to an end?

How about animals? Do animals also have intrinsic value, or do they merely have extrinsic value, e.g. the value of being used by humans as a means to (our) ends?

Questions for discussions:

- ♦ What would make animals not have intrinsic value the way humans do?
- ♦ What is the key difference that gives us rights and moral standing, but not animals?
- ♦ Do some animals have more (or a different degree of) intrinsic value than others? Why?

Religious and philosophical views on the value of animals

4.  With a partner, decide which of the following quotes from a variety of religious and philosophical texts considers animals to have intrinsic value, (only) extrinsic value, or a bit of both? (see completed chart below)

Hebrew Scripture/Old Testament:

“Six days thou shalt do thy work, and on the seventh day thou shalt rest: that thine ox and thine ass may rest, and the son of thy handmaid, and the stranger, may be refreshed.” (*Exodus*)

“You shall not muzzle an ox when it is treading out the grain.” (*Deut. 25:4*)

“Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.” (*Genesis*)

“For the fate of the sons of men and the fate of beasts is the same. As one dies so dies the other; indeed, they all have the same breath and there is no advantage for man over beast, for all is vanity.” (*Ecclesiastes 3:19*)

“His compassion rests upon all his creatures.” (*Psalms 145:9*)

New Testament:

“What man of you, if he has one sheep and it falls into a pit on the sabbath, will not lay hold of it and lift it out? Of how much more value is a man than a sheep! So it is lawful to do good on the sabbath.” (*Matthew 12:11-12*)

St. Thomas Aquinas:

“... according to the Divine ordinance the life of animals and plants is preserved not for themselves but for man. Hence, as Augustine says (*De Civ. Dei* i, 20), ‘by a most just ordinance of the Creator, both their life and their death are subject to our use.’” (*Summa Theologica*)

Francis of Assisi:

“Not to hurt our humble brethren is our first duty to them, but to stop there is not enough. We have a higher mission—to be of service to them wherever they require it.” (*Francis of Assisi*)

Hinduism:

“Having well considered the origin of flesh foods. And the cruelty of fettering and slaying corporeal beings let man entirely abstain from eating flesh.” (*Manusmriti* 5.49., Early Hindu scripture)

“To my mind the life of a lamb is no less precious than that of a human being. I should be unwilling to take the life of a lamb for the sake of the human body. I hold that, the more helpless a creature, the more entitled it is to the protection by man from the cruelty of man.” (Mahatma Gandhi)

“I abhor vivisection with my whole soul. All the scientific discoveries stained with innocent blood I count as of no consequence.” (Mahatma Gandhi)

Jainism:

“In happiness and suffering, in joy and grief, we should regard all creatures as we regard our own self, and should therefore refrain from inflicting upon others such injury as would appear undesirable to us if inflicted upon ourselves.” (*Yogashastra*, Jain Scripture)

“This is the quintessence of wisdom; not to kill anything. All breathing, existing, living sentient creatures should not be slain, nor treated with violence, nor abused, nor tormented, nor driven away. This is the pure unchangeable Law. Therefore, cease to injure living things.” (*Yogashastra*, Jain Scripture)

Buddhism:

“All living things fear being beaten with clubs. All living things fear being put to death. Putting oneself in the place of the other, Let no one kill nor cause another to kill.” (*Dhammapada* 129, Karma and status)

Native American:

“What is a man without the beasts? If all the beasts were gone, men would die from great loneliness of spirit, for whatever happens to the beasts also happens to man.” (Chief Seattle)

Aristotle:

“In like manner we may infer that, after the birth of animals, plants exist for their sake, and that the other animals exist for the sake of man, the tame for use and food, the wild, if not all at least the greater part of them, for food, and for the provision of clothing and various instruments. Now if nature makes nothing incomplete, and nothing in vain, the inference must be that she has made all animals for the sake of man.” (*Politics*)

Immanuel Kant:

“...every rational being, exists as an end in himself and not merely as a means to be arbitrarily used by this or that will...Beings whose existence depends not on our will but on nature have, nevertheless, if they are not rational beings, only a relative value as means and are therefore called things. On the other hand, rational beings are called persons inasmuch as their nature already marks them out as ends in themselves.” (*Groundwork of the Metaphysics of Morals*)

“So far as mere reason can judge, man has duties only to man; for his duty to any subject is moral necessitation by that subject's will. Hence the necessitating (obligating) subject must, first, be a person; and this person must, secondly, be given as an object of experience . . . but with all our experience we know of no being other than man that would be susceptible of obligation. Therefore man can have no duties to beings other than man.” (*Metaphysics of Morals*)

Jeremy Bentham:

The day may come when the rest of the animal creation may acquire those rights which never could have been withholden from them but by the hand of tyranny. The French have already discovered that the blackness of the skin is no reason why a human being should be abandoned without redress to the caprice of a tormentor. It may one day come to be recognized that the number of the legs, the villosity of the skin, or the termination of the os sacrum, are reasons equally insufficient for abandoning a sensitive being to the same fate. (*An Introduction to the Principles of Morals and Legislation*)

What else is it that should trace the insuperable line? Is it the faculty of reason, or perhaps the faculty of discourse? But a full-grown horse or dog is beyond comparison a more rational, as well as a more conversable animal, than an infant of a day, or a week, or even a month, old. But suppose they were otherwise, what would it avail? The question is not, Can they reason? nor, Can they talk? but, Can they suffer? (*An Introduction to the Principles of Morals and Legislation*)

Arthur Schopenhauer:

“Compassion for animals is intimately associated with goodness of character, and it may be confidently asserted that he, who is cruel to living creatures, cannot be a good man.” (*On the Basis of Morality*)

“The assumption that animals are without rights and the illusion that our treatment of them has no moral significance is a positively outrageous example of Western crudity and barbarity. Universal compassion is the only guarantee of morality.” (*On the Basis of Morality*)

PRIMARILY INTRINSIC	PRIMARILY EXTRINSIC	NOT SURE/BOTH (?)
BUDDHISM JAINISM FRANCIS OF ASSISI BENTHAM SCHOPENHAUER	NEW TESTAMENT THOMAS AQUINAS ARISTOTLE KANT	HEBREW SCRIPTURE/ OLD TESTAMENT HINDUISM NATIVE AMERICAN(?)

5.  Collect and discuss students' findings.

Questions to consider:

- What are the main criteria used in these quotes to determine whether animals have intrinsic or extrinsic value?
- Which of the arguments/criteria used to determine how we should treat animals do you find most compelling, and why?
- Do you believe that there is a conclusive (objective) answer to this question, or is it ultimately up to each individual person to decide how to treat animals?
- What additional information do we need to arrive at a conclusion?

4. The Modern Philosophical Debate about Animal Use in Research

In this section, we will discuss the modern philosophical debate on the issue of the use of animals in research. Students will explore positions on the issue, held by four prominent ethicists, namely Peter Singer (preference utilitarian), Tom Regan (animal rights), Bernard Rollin (welfarist), and Arthur Caplan (welfarist). After considering possible arguments pro and contra vivisection, students will be introduced to some basic facts about the scale and nature of animal use in research today, followed by a discussion of views of the four ethicists mentioned above, about the moral issues concerning the use of animals in research.

The debate about vivisection

The question of the treatment of animals (in the West) began with a public debate about the pros and cons of vivisection in England in the 19th century. This debate led to the first legislation on the treatment of animals in 1876, and then in 1911.

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 What is vivisection? (Etymology: Combination of the Latin words “vivus” (alive) and “secare” (to cut). You may consider showing students a picture of the vivisection of a frog (see below). (Teacher discretion is advised.)



- 
 Based on our discussions so far, what do you think would have been the main arguments for and against vivisection, when this first became an issue in England in the 19th century?
- 
 Collect and discuss students' findings, then share with students some of the actual arguments used in the debate, and the principles on which these arguments were based, as well as information about the legislation that resulted from the debate about vivisection.

	Pro Vivisection	Contra Vivisection
Need:	For human health and well being; no real alternatives.	We can eliminate much of the animal research we currently conduct; continued reliance of scientists on animal models b/c of an economic or financial power structure maintaining the status quo; cosmetics
Moral Equity:	Animals don't experience pain and distress the way humans might; humans count more.	Research shows animals are remarkably similar to humans; sentience, consciousness; feel pain.
Priority:	There's plenty of misery in human conditions that could use the attention of the antivivisectionists.	High priority b/c animals are vulnerable to unavoidable suffering caused by humans.

Facts about the Movement against Vivisection:

The Society for the Protection of Animals Liable to Vivisection, the first antivivisection organization in the world, was founded in London in 1875 by Frances Power Cobbe, a feminist philosopher and reformer.

The British Union for the Abolition of Vivisection stimulated discussion and policy formation around animal welfare in Great Britain.

- Cruelty to Animals Act of 1876

Main provisions:

- Prohibits painful experiments on animals other than in accordance with the Act
- Provides for the proper care of animals used for experimentation
- Experimentation may only take place with a license

- Protection of Animals Act, 1911.

As amended by Protection of Animals (Amendment) Act, 1965 (S.I. 10 of 1965) and Control of Horses Act, 1996 (S.I. 37 of 1996)(as regards penalties)

This remains the main legislation prohibiting cruelty to animals. Section 15 defines an "animal" as "any domestic or wildanimal and includes any bird, fish or reptile"

Section 1 defines the offence of cruelty as follows:

- (1) If any person(a) shall cruelly beat, kick, ill-treat, over-ride, over-drive, over-load, torture, infuriate, or terrify any animal, or shall cause or procure, or, being the owner, permit any animal to be so used, or shall, by wantonly or unreasonably doing or omitting to do any act, or causing or procuring the commission or omission of any act, cause any unnecessary suffering, or, being the owner, permit any unnecessary suffering to be so caused to any animal

Contemporary use of animals in research

While vivisection constituted a very small part of research in the 19th century when the debate about vivisection took place, animal use is now a huge part of research and experimentation in many different industries.

Number of animals currently used in research in the US:

Recent (fiscal year 2009) United States Department of Agriculture (USDA) statistics list a total of 1,136,841 primates, dogs, cats, rabbits, guinea pigs, hamsters, and other species as being subjected to experimental procedures. The species by species listings include:

72,037 dogs
69,990 primates
65,615 pigs
236,511 rabbits
22,687 cats
172,498 hamsters
31,106 other farm animals
13,240 sheep
136,509 other animals
207,257 guinea pigs

The species that are not covered by the Animal Welfare Act, such as rats, mice, etc. are not counted. Additionally, these statistics do not cover animals that are caged in laboratories but are being held for conditioning or breeding. (from: <http://www.all-creatures.org/saen/fact-anex-jun09.html>)

Four views of contemporary philosophers

In the following, students will be introduced to the views of four prominent ethicists on the use of animals in research.

4.  Introduction: The four ethicists discussed in this section of the unit represent different positions in the current debate on the treatment of animals. Your task will be to identify the key arguments contained in the views they hold.

5.  Students will work in small groups. They will be provided information on each of the four thinker's position. Students may—alternatively—be provided with the information on one of these thinkers listed below, be asked to research them independently, or both.

Each group will try to answer the following questions about the view of the ethicist they have been assigned:

- What is the main criterion or guiding principle used to determine how we should treat animals?
- Does your ethicist believe that to conduct research on animals is morally legitimate, or not?
- Do you agree with the position represented by your ethicist? Why? Why not?

#1 PETER SINGER

This book [*Animal Liberation*] is about the tyranny of human over nonhuman animals. This tyranny has caused and today is still causing an amount of pain and suffering that can only be compared with that which resulted from the centuries of tyranny by white humans over black humans. The struggle against this tyranny is a struggle as important as any of the moral and social issues that have been fought in recent years. —*Animal Liberation*

[The A]rgument about vivisection ... has been put in absolutist terms: would the abolitionist [i.e. a person in favor of abolishing animal testing] be prepared to let thousands die if they could be saved by experimenting on a single animal? The way to reply to this purely hypothetical question is to pose another: Would the experimenter be prepared to perform his experiment on an orphaned human infant, if that were the only way to save many lives? If the experimenter is not prepared to use an orphaned human infant, then his readiness to use nonhumans is simple discrimination, since adult apes, cats, mice, and other mammals are more aware of what is happening to them, more self-directing and, so far as we can tell, at least as sensitive to pain, as any human infant.

There seems to be no relevant characteristic that human infants possess that adult mammals do not have to the same or a higher degree. Someone might try to argue that what makes it wrong to experiment on a human infant is that the infant will, in time and if left alone, develop into more than the nonhuman, but one would then, to be consistent, have to oppose abortion, since the fetus has the same potential as the infant—indeed, even contraception and abstinence might be wrong on this ground, since the egg and sperm, considered jointly, also have the same potential. In any case, this argument still gives us no reason for selecting a nonhuman, rather than a human with severe and irreversible brain damage, as the subject for our experiments. —*All Animals Are Equal*

#2 TOM REGAN

There are many people who feel that we have an obligation to be kind to animals, and not to be cruel to them. But this view doesn't make it a matter of justice that we treat animals in a certain way—just that it is nice if we are kind and not very good if we are cruel. Many people think that we should be nice to animals because if we are not nice to animals we will not be nice people, and then we will end up beating up our children and our neighbors and so on. The problem is, these views don't focus on our duty to animals but only on the effects our treatment of animals has on us. The rights view says, "We owe it as a matter of strict justice to treat animals in a certain way." In particular we owe it to these animals not to eat them, for example, or not to put them in cages for our entertainment, or not to use them in education or in surgery, which is so

anachronistic and yet characteristic of modern medical education in the United States. The current view is, "These animals are ours, we may do with them as we wish." The rights view says, "No you may not. They cannot claim their rights, they cannot understand their rights, and in this way they are very much like mentally enfeebled human beings. But they have them none the less." (Interview, taken from: <http://www.mothercow.org/oxen/animal-rights.html>)

In the case of the use of animals in science, the rights view is *categorically abolitionist*. Lab animals are not our tasters; we are not their kings. Because these animals are treated routinely, systematically as if their value were reducible to their usefulness to others, they are routinely, systematically treated with a lack of respect, and thus are their rights routinely, systematically violated.

This is just as true when they are used in trivial, duplicative, unnecessary or unwise research as it is when they are used in studies that hold out real promise of human benefits.

We can't justify harming or killing a human being (my Aunt Bea, for example) just for these sorts of reason. Neither can we do so even in the case of so lowly a creature as a laboratory rat. It is not just refinement or reduction that is called for, not just larger, cleaner cages, not just more generous use of anesthetic or the elimination of multiple surgeries, not just tidying up the system. It is complete replacement. The best we can do when it comes to using animals in science is *not to use them*. That is where our duty lies, according to the rights view. (-The Case for Animal Rights)

#3 BERNARD ROLLIN

(on Legal Protection of Apes:)

Consider, then, a chimpanzee or an orang-utan or a gorilla who has learned to communicate with humans using a system perceived by most people as indeed linguistic. The experiment is terminated, and the animal is no longer of use and is turned over to a zoo, or to a laboratory. When I first discussed this sort of case, in the late 1970s, this scenario was hypothetical. By the late 1980s, however, it was all too real. Unfortunately, as Eugene Linden has so deftly documented, this sort of case has occurred with heart-rending frequency. Linden has told of how these animals have communicated their sorrow and perplexity and anxiety and anger and fear and grief when they are wrenched out of a rich environment where they were being treated as 'honorary humans' -sometimes living as a child in the researchers' homes - and suddenly incarcerated in a place where they are used for invasive research, and have no one, human or ape, to communicate with, and live wretched, isolated, deprived, lives. Most tragic, perhaps, is that they cannot understand what they have done to merit what they, in their sublime innocence, must surely see as punishment.

Here, I have suggested, we can accelerate the moral and

legal enfranchisement of animals, at least of these animals, by using the extant legal machinery, and letting them tell their story in the context of the judicial system. I am envisioning a plausible legal case based on the notions of denial of due process and cruel and unusual punishment. Surely one can make the reasonable case that these animals are, by all rational standards, persons who have been denied the fundamental civil rights and procedures due to persons. These animals possess measurable intelligence, sometimes in excess of that possessed by certain humans, they can reason and, most important, they can eloquently speak for themselves, and tell of their anguish and sorrow.

I am thus envisioning a new 'monkey trial', at least as spectacular in its appeal and implications as the Scopes trial, which tested the Tennessee law against the teaching of evolution. Such a trial would be extraordinarily salubrious in just the same sense...This trial would force an examination of our moral and attendant legal commitments, and illuminate areas too long left in the dark.

Whatever the outcome of such a trial, the animals would of necessity win. If the trial were lost, the issues would still have been powerfully and unforgettably aired, and the failure of our current law and morality to protect these innocent creatures forcefully and indelibly imprinted in the public mind. Indeed, even if the case never came to trial, the same result would be accomplished by the vast - and doubtless sympathetic - publicity which a skilful attempt orchestrated by first-rate legal, philosophical and scientific minds would undoubtedly generate. And, in the end, the new ethic we discussed earlier would be articulated and enlivened, to the benefit of all animals, and most assuredly to the benefit of the great apes, whose shameful treatment at human hands occasioned the need for the trial. (The Ascent of Apes—Broadening the Moral Community. From: <http://www.animal-rights-library.com/texts-rollin01.htm>)

#4 ART CAPLAN

If animals and humans are so organized as to be purposive creatures with various desires, drives, intentions, and aspirations, it seems wrong to cavalierly frustrate these purposes. It might be argued that if animals and humans are biologically constituted so as to pursue their own existence, which is a fact quite consistent with current thinking in evolutionary theory, then it is morally wrong to interfere with or deprive animals of the opportunity to fulfill this basic drive. In other words, animals and humans, endowed by nature with a will to survive, have a right to survive-rights being consequent upon the purposiveness and teleological orientation of living things. If all creatures who possess purposiveness have a right to be left alone to pursue their ends, then the basic moral repugnance felt by many people about animal experimentation can be easily understood-most experimentation deprives animals of the right to exist, or, at minimum, frustrates

certain basic drives and intentions they manifest. While human beings are under no moral obligation to aid their fellows or animals in the pursuit of their basic purposes, they do appear to be under some constraint not to uncaringly interfere with other organisms.

I believe that purposiveness rather than sentience is a property that succeeds for conferring moral worth upon entities. When organisms have sufficient organization to have basic drives, desires, and intentions, be they amoebas, bees, birds, or retarded humans, it is wrong to interfere with their efforts to fulfill these desires. It needs to be quickly added that such interference is wrong unless there exists some other reason or justification for doing so. The fact is that, as is the case with the abortion debate, most persons erroneously believe that once animal rights are established, the issue of animal experimentation is settled. If it is wrong to interfere with purposive creatures, then no animal research could ever be morally legitimate. But such a view confuses the question of how moral worth and moral rights arise with the question of what to do when rights conflict—a common, ordinary, and unavoidable consequence of the nature of the world we live in. No animals or humans capable of purposiveness should be interfered with by others, other things being equal. But other things are rarely equal. If humans are to survive, they must eat, and animals may have to suffer the consequences. If human beings are to fulfill their desires to have medicines, then some creatures will have to suffer in the course of discovering whether different substances have therapeutic value. While it is true that we ought not interfere with or hinder the bringing to fruition of the desires and purposes of others, animals and humans, in a world of limited resources and conflicting purposes, some creatures will, of necessity, have their basic rights overridden. (...)

Perhaps the strongest caveat to emerge from an analysis of the morality of animal research is that the burden of proof always rests upon the experimenter to justify the use of animals in experimental contexts. The antivivisectionist has nothing to prove; many animals used in experiments are sentient and purposive, and thus have prima facie rights to live and be left alone. Those who would override or abrogate these rights must provide compelling reasons for doing so. Humility and sensitivity, not arrogance and hubris, must be the hallmarks of animal research since it is only out of ignorance and expediency that we put members of the animal kingdom to our purposes rather than theirs. The other conclusion that follows from the analysis of the moral legitimacy of animal experimentation is that such activity is always morally tragic. No matter what goods are promoted by the process, some creatures who are unable to alter their circumstances will have their basic rights of life and fulfillment infringed.

Since this is so, it would seem imperative that steps be taken to reduce waste and duplication in the use of animals for research purposes, put more funds toward the development of alternatives to animal testing, and make

the public aware of the moral trade-offs that must be faced in deciding how best to achieve human well-being, health, safety, and knowledge at the expense of animal suffering. Ultimately, the public will have to decide what sorts of trade-offs are morally acceptable when animal and human interests conflict. (-Beastly Conduct: Ethical Issues in Animal Experimentation)

6.  Collect and discuss students' findings. Whatever our beliefs are with regard to how animals should be treated, and whether it is morally permissible to use them in research, it seems likely that we would be in favor of some kind of regulation of the treatment of animals. As we will see in the next section of this unit, some of the issues we have discussed so far will re-emerge in our discussion of current regulations (e.g. Caplan's point about the conflict between the rights of humans and those of animals).

5. Rules and Regulations

Animal use & the protection of human research subjects

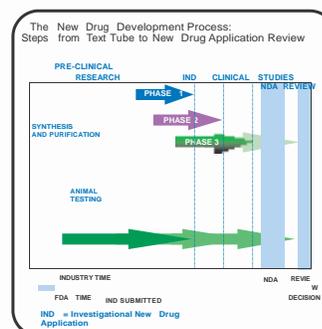
One of the problems with the establishment of rules and regulations concerning the welfare of animals is that those regulations may conflict with the principles and regulations aimed at protecting human beings.

The Nuremberg code, for example, states:

“The experiment should be so designed and based on the results of animal experimentation and a knowledge of the natural history of the disease or other problem under study that the anticipated results will justify the performance of the experiment.”

Accordingly, animals are used for foundational research in:

- basic life science and behavioral research relies on animal models
- INDs based on phase I - FDA- preclinical testing
- new drug applications (NDAs) must include animal data
- determining risk: some animal data might need to be included in informed consent during human subjects research



Source:
USFDA website



1. Ask students, in what way the use of animals in foundational research represents a direct conflict between the protection of human beings and animals.

Further discussion questions:

- ♦ Even if we believe that we should never intentionally inflict pain or suffering on animals, what if such treatment would lower the risk of inflicting pain or suffering on humans?
- ♦ If we have to choose between an animal and a human being as the subject of a research project, is it ever justified to use a human subject instead of an animal?



2. Discuss with students the following controversial cases of animal use in research meant to protect human beings:

The use of animals in toxicology testing (also known as safety testing): Pharmaceutical companies or animal testing facilities test the safety of chemicals used in a variety of products. These tests are typically conducted without anesthesia, because drugs used for anesthesia could interfere with test results. The substances that are being tested are applied to skin or dripped into the eyes of animals; injected intravenously, intramuscularly, or subcutaneously; inhaled; or administered orally.

Two especially controversial acute toxicity tests are the LD50 ("Lethal Dose 50%")-Test, and the Draize test: The LD50 test is used to evaluate the toxicity of a substance by determining the dose required to kill 50% of the test animal population. Another type of toxicity test, the Draize-test, consists in applying a test substance to an animal's eyes or skin, usually an albino rabbit.

(Adapted from: http://en.wikipedia.org/wiki/Animal_testing)

Discussion questions:

- ♦ In what way do these cases represent an example of a direct conflict between the rights and interests of humans and animals?
- ♦ Would it be justified to ban these tests, even if that would increase the risk of humans being hurt or killed by exposure to toxic substances?

Animal Welfare Act of 1985

Standards dictated by the Animal Welfare Act:

- ♦ Balancing societal benefits with imposition on animals (with respect to suffering and numbers of animals used).
- ♦ Minimization of pain, suffering, and distress in all procedures

- ♦ Species-appropriate housing, feeding, and care
- ♦ Involvement of veterinary personnel
- ♦ Qualifications of investigators and their personnel.

Public Health Service policy on Humane Care and Use of Laboratory Animals:

- ♦ Public Health Service Policy on the Humane Care and Use of Laboratory Animals
- ♦ Nine United States Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research and Training; all species of animals including birds, mice and rats; all research that is funded by the National Institutes of Health (NIH).
- ♦ Institutions must annually submit a written document called an assurance to NIH, which documents how the institution is complying with all the regulations covering animals used in research.
- ♦ The Office of Laboratory Animal Welfare (OLAW) at NIH is the agency that is responsible for enforcement of this policy.
- ♦ The Guide for the Care and Use of Laboratory Animals recognizes the blurred boundary between laboratory and farm research, teaching, and testing and acknowledges that specific standards for the use of animals in these two settings differ even as basic ethical principles for treatment of animals remain the same. [source: Univ. of Minnesota]

Questions for Discussion:

- ♦ Do you believe the wording of these regulations is specific enough to ensure the protection of animals from unnecessary suffering? (e.g. "balancing societal benefits with imposition on animals," "minimizing of pain," "species-appropriate.")
- ♦ In what way does the lack of specificity reflect the ambiguities about the treatment of animals we have also encountered in our previous discussions?
- ♦ What is a fundamental assumption that is implied in these regulations?

Institutional Animal Care and Use Committees—case studies/role-playing

- Jurisdiction:** The IACUC has the responsibility to evaluate, report on, and inspect the facilities of all units employing animals for research, teaching, or testing.
- Mission:** The mission of the IACUC is to assure the humane handling, care, treatment, and transportation of covered animal species.

Jurisdiction: The IACUC has the responsibility to evaluate, report on, and inspect the facilities of all units employing animals for research, teaching, or testing.

Structure: IACUCs must have a minimum of three members:

- ✦ at least one of whom must be a doctor of veterinary medicine.
- ✦ one must be a practicing scientist with relevant animal experience
- ✦ at least one must be a "public member" not otherwise associated with the institution or an immediate family member of someone affiliated with it and who is not a user of laboratory animals.

The three main criteria used in the evaluation of animal used in research are:

- Provide a clear rationale of animal use
- Justify number of animals used in study
- Risk/benefit Analysis
 - ✦ Subjecting animals to risk or certainty of discomfort, pain, and distress requires that the scientific benefits be at least commensurate.
 - ✦ Investigators are responsible for designing research in which benefits outweigh risks or harm to animals and for persuading the IACUC that this is so.
 - ✦ Investigators must show that there are no acceptable alternatives to animal use.
 - ✦ Alternatives may include non-animal alternatives, but also include concepts such as using the "lowest" species possible, minimizing the numbers used (statistical planning of the experiment, minimizing variability within the model, etc.) and minimizing the pain/distress associated with a particular model.

[Source Univ. of Minnesota]

1.  Students will get into groups of three. (Each of the group members may take on the role of one of the persons on an IACUC: veterinarian, scientist, "public member".) Each group will examine an example of an actual animal research protocol and try to reach a consensus on whether the study should be approved or not. To that end, students should answer the following questions:

- Do you (the IACUC) believe that this study is in compliance with current rules, regulating the humane treatment of animals used in research, and should therefore be approved?
- Do you believe, independent of the official rules and regulations that the use of animals (including the infliction of discomfort, pain, and/or death) is justified in this research project, or not?

Example 1

Study heart mechanics after resynchronisation and evaluate heart efficiency

Heart failure is an increasingly global disease. This is caused by a range of different mechanisms (e.g. heart attack), which ultimately weakens the heart to contract and results in failure. To ensure optimal contraction, the heart's four chambers have to work in a synchronous fashion. In some diseased hearts this contraction is dyssynchronous, that means that some parts of the heart contract earlier than others, and a part of the work performed by the heart does not result in ejection of blood into the circulation. To rectify this abnormality pacemakers have been introduced in some patient groups with heart failure to resynchronise the heart. Unfortunately not all patients respond to this therapy and some even become worse.

In an attempt to improve patient selection we wish to conduct animal experiments with pacemakers where we induce heart failure to study heart mechanics after resynchronisation by looking at the efficiency of the heart.

It is unethical to conduct these tests on humans. There are data models which could simulate the heart's function, but these are too simplistic to replace the data collected during an animal experiment and would be of low scientific value. These experiments rely upon an intact organism with intact regulatory mechanisms. Due to the invasive nature of the experiment and size of instruments, animals smaller than dogs are less useful because of the frequent occurrence of lethal irregular heart rhythms and lower tolerance of the cardiovascular system.

Study protocol

Mixed-breed dogs bred specifically for research purposes. Age 2-3 years, weight 25-35 kg. Experiments are performed in a standard operating theatre. The animal receive a venous cannula in one forelimb. Initiation of anesthesia is started with sodium thiopental (25 mg/kg) followed by pentobarbital (4mg/kg). Anaesthesia is maintained with a continuous infusion of pentobarbital (2mg/kg/hr) and morphine (3mg/kg/hr) iv. Intubation is performed and a respirator is connected. A urine catheter, ECG and pulse oximeter are then connected. Sternotomy is performed and the heart exposed. Pressure catheters are inserted into the aorta, left ventricle and atrium. Ultrasonic crystals are implanted in various areas of the myocardium. Constrictors are inserted over the vena cava and aorta, and a Swan-

Ganz catheter is inserted into the pulmonary artery. During the experiment, pressure measurements are made in the heart chambers. Monitoring includes measurement of blood gasses, body temperature and anaesthesia. The animals are euthanized while remaining under anaesthesia using 100mg/kg iv pentobarbital.

Example 2

Protective effect of medicinal plant polysaccharides against systemic *Streptococcus pneumoniae* infection in mice

Aims of my research and the reason for using experimental animals.

A major public health concern today is the increase of bacteria resistant to antibiotics. It is therefore of importance to find preventive and curative alternatives to existing antibiotics. A strain of bacteria that has shown resistance towards antibiotics is *Streptococcus pneumoniae*. This bacterium may cause potentially lethal diseases like meningitis.

Studies have shown that specific plant sugars, for instance glucans and pectins, protect against various bacterial infections, and stimulate the immune system. These studies have mainly been performed in vitro, that is outside the living organisms. In order to find out if these substances are active also in vivo, within a living organism, and to study the mechanism behind this effect, the use of experimental animals is necessary. The research will study whether characterized pectins isolated from Malian medicinal plants can give protection against *S. pneumoniae* infection. Mice will be given certain doses of the pectin before challenge with *S. pneumoniae*.

In Mali, West Africa, approximately 80% of the population relies almost entirely on traditional medicines for their primary healthcare. The provision of safe and effective therapies based on traditional medicine would therefore become a critical tool to increase access to health care in the country. The positive side of using plant sugars as therapeutics is that to date, no negative or toxic effects have been recorded for this group of natural compounds.

Study protocol

The mice will be given the test substances as intraperitoneal injections 3 h prior to challenge with *Streptococcus pneumoniae* serotype 6B. Mice will be followed for survival over a 9 day incubation period. Determination of survival and blood sampling will be performed at 3h, 24h, 48h, 72h, 96h and 9 days after challenge with *S. pneumoniae*. Blood samples of 25µl will be drawn from the distal part of the lateral femoral vein of each mouse. 10µl of the blood will be used for seeding onto blood agar plates to determine the number of colony forming units (CFU). The rest will be stored at -80°C for cytokine analysis later.

Mice that are moribund will be euthanized by cervical dislocations, and the time of euthanasia will be recorded as

the survival time. At the time of euthanasia blood samples from the abdominal cavity will be drawn for measurements of macrophage activity in this region.

Test substances to be used are the pectic polysaccharides PmII from *Plantago major*, BP1002 from *Biophytum petersianum*, Oc50A1.I.A from *Opilia celtidifolia*, CC1P1 from *Cola cordifolia* and Vk1a from *Vernonia kotschyana*. Lipopolysaccharide (LPS) will be used as a positive control, and phosphate-buffered saline (PBS) as control. All test substances will be dissolved in 0.4 ml PBS and given in doses of 125µg, 25µg and 5µg per animal.

Example 3

Colitis mouse model to study IgA on microbial composition and mucosal immunity

The main goal of this project is to explore the interaction between intestinal microbes and secretory immunity. We will use a colitis mouse model to observe the effect of IgA on microbial composition and distribution and thereby investigate the importance of polymeric immunoglobulin receptor (pIgR) which plays a vital role in mucosal immunity. In my research project I will use Balb/cJ mice knocked out for polymer immunoglobulin receptor, compared to wild type mice.

No alternative to an animal model is possible due to the intricacy of the system being investigated:

Since we are unable to create physically 800-1000 commensal bacteria in the human intestinal environment, we wish to generate such a type of microenvironment in laboratory animals. As we know polymeric Ig receptor neutralizes intestinal bacteria; we want to investigate this receptor, so we need the bacteria.

In vitro studies can be used to create a monolayer of intestinal epithelial cells, but they cannot create the unique environment in the intestine, including subepithelial inflammatory cells, blood vessels, commensal bacteria, fungi and so on.

To determine the composition of intestinal microbes on bacterial fecal pellets and cecal content there is no alternative to experimental animals.

The animals will be 5-7 weeks old; this will probably create variable tumor progression since younger animals are more sensitive to the carcinogen. In the pilot we will consider this fact, and improve breeding techniques in further experiments.

(Examples taken from:

http://www.vetmed.ucdavis.edu/Animal_Alternatives/researchexamples.htm)

-  Groups will present their findings. Ask students to provide reasons for their answers. Additional discussion questions:

✦ Did your answer to the second questions differ from that to the first question? If so, why?

✦ How did you arrive at your answers?

- ♦ What principles, if any, did you use in addition to those articulated in official regulations?
- ♦ If students were assigned roles (veterinarian, scientist, “public member”), was that a factor in coming up with a decision?
- ♦ Do you believe that alternatives to the use of animals in these studies are available, or may become available in the future?

Alternatives to Animal Use in Biomedical Research

Based on what we have talked about so far and regardless of where we come down on some of the issues, it seems that we will always have to make tough decisions when it comes to weighing the protection of animals and the benefits of biomedical research to humans. But what if we could find alternatives to the use of animals in research? According to one of the generally accepted principles for the use of animals in research, namely “replacement,” (the other two being “reduction” and “refinement”), non-animal methods should be preferred over animal methods whenever the same scientific aim can be achieved.

5.  With a partner, students should consider ways in which animal use in research could, in the future, be replaced by other methods that do not involve animals (or humans). Encourage students to be as imaginative as possible. (If necessary, mention, as possible candidates for the development of such new methods: computer technology, stem cell research, cloning, etc.)

6.  Collect and discuss students’ findings. Mention that some of similar ideas are actually already being explored. Share with students the article “Reconstituting Organ-Level Functions on a Chip,” in “Science,” or just the abstract of the article, below:

Science 25 June 2010:
Vol. 328, no. 5986, pp. 1662-1668
DOI: 10.1126/science.1188302

Reconstituting Organ-Level Lung Functions on a Chip

Donggeun Huh,^{1,2} Benjamin D. Matthews,^{2,3} Akiko Mammoto,² Martín Montoya-Zavala,^{1,2} Hong Yuan Hsin,² Donald E. Ingber^{1,2,4,*}

Here, we describe a biomimetic microsystem that reconstitutes the critical functional alveolar-capillary interface of the human lung. This bioinspired microdevice reproduces complex integrated organ-level responses to bacteria and inflammatory cytokines introduced into the alveolar space. In nanotoxicology studies, this lung mimic revealed that cyclic mechanical strain accentuates toxic and inflammatory responses of the lung to silica nanoparticles. Mechanical strain also enhances epithelial and endothelial uptake of nanoparticulates and stimulates their transport into the underlying microvascular channel. Similar effects of physiological breathing on nanoparticle absorption are observed in whole mouse lung. Mechanically active “organ-on-a-chip” microdevices that reconstitute tissue-tissue interfaces critical to organ

function may therefore expand the capabilities of cell culture models and provide low-cost alternatives to animal and clinical studies for drug screening and toxicology applications.

- 1 Wyss Institute for Biologically Inspired Engineering at Harvard University, Boston, MA 02115, USA.
2 Vascular Biology Program, Departments of Pathology and Surgery, Children’s Hospital Boston, and Harvard Medical School, Boston, MA 02115, USA.
3 Department of Medicine, Children’s Hospital Boston, Boston, MA 02115, USA.
4 School of Engineering and Applied Sciences, Harvard University, Cambridge, MA 02138, USA.

7.  Discuss with the students the following questions:

- ♦ How is this article relevant in the context of this unit?
- ♦ Do you believe that the technology described in this article could one day replace all use of animals in research?
- ♦ Do you believe that finding alternatives to the use of animals in research will put an end to the discussion about the treatment and moral status of animals? Why? Why not?

References and Additional Resources

Introduction and animal use in research (general):

Common Core State Standards:

http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf

Wikipedia-Website on Animal Testing:

http://en.wikipedia.org/wiki/Animal_testing

University of Minnesota website on Research Animal Resources:

<http://www.ahc.umn.edu/rar>

2. Animal Use, Cases and Controversies:

Articles on Whole Food’s ban of selling live lobsters:

New York Times:

<http://www.nytimes.com/2006/06/10/us/10crabs.html>

USAToday:

http://www.usatoday.com/money/industries/food/2006-06-15-lobsters-ap_x.htm

Whole Food’s Website:

<http://www.wholefoodmarket.com/values/live-lobster.php>

3. Moral status and questions of value:

Article on the moral status of animals (Stanford Encyclopedia of Philosophy):

<http://plato.stanford.edu/entries/moral-animal/>

4. The modern philosophical debate about animal use in research:

Facts about animals used in research:

<http://www.all-creatures.org/saen/fact-anex-jun09.html>

Singer, Peter. *Animal Liberation: A New Ethics for our Treatment of Animals*. Harper Perennial Modern Classics, New York, 2009.

Singer, Peter. In: Tom Regan & Peter Singer (eds.) *Animal Rights and Human Obligations*, New Jersey, 1989, pp. 148-162

<http://www.animal-rights-library.com/texts-m/singer02.htm>

Rollin, B.E. The Ascent of Apes—Broadening the Moral Community. In: Paola Cavalieri & Peter Singer (eds.), *The Great Ape Project*. New York: St. Martin’s Griffin, 1993, pp. 206-219

<http://www.animal-rights-library.com/texts-m/rollin01.htm>

Regan, Tom. The Case for Animal Rights. In: Peter Singer (ed.), *In Defense of Animals*. New York: Basil Blackwell, 1985, pp. 13-26

<http://www.animal-rights-library.com/texts-m/regan03.htm>

Caplan, Arthur L. *Beastly Conduct: Ethical Issues in Animal Experimentation*. Institute of Society, Ethics and the Life Sciences. The Hastings Center. Hastings-on-Hudson, New York 10706

5. Rules and regulations:

Animal Welfare Act of 1985

Public health service policy on Humane Care and Use of Laboratory Animals

Abstract of "Reconstituting Organ-Level Lung Functions on a Chip"

Alternatives to the use of animals in research at USDA (United States Department of Agriculture)- Website:

http://awic.nal.usda.gov/nal_display/index.php?info_center=3&tax_level=1

Appendix: Pennsylvania Academic State Standards Addressed in this Unit

READING, WRITING, SPEAKING AND LISTENING (Grade 11)

1.1. Learning to Read Independently

- D. Identify, describe, evaluate and synthesize the essential ideas in text. Assess those reading strategies that were most effective in learning from a variety of texts.
- F. Understand the meaning of and apply key vocabulary across the various subject areas.
- G. Demonstrate after reading understanding and interpretation of both fiction and non-fiction text, including public documents.
- Analyze the positions, arguments and evidence in public documents
 - Critique public documents to identify strategies common in public discourse.

1.2. Reading Critical in All Content Areas

- A. Read and understand essential content of informational texts and documents in all academic areas.
- Differentiate fact from opinion across a variety of texts by using complete and accurate information, coherent arguments and points of view.
 - Distinguish between essential and nonessential information across a variety of sources, identifying the use of proper references or authorities and propaganda techniques where present.
 - Use teacher and student established criteria for making decisions and drawing conclusions
 - Evaluate text organization and content to determine the author's purpose and effectiveness according to the author's theses, accuracy, thoroughness, logic and reasoning.

1.6. Speaking and Listening

- A. Listen to others.
- Ask clarifying questions.
 - Synthesize information, ideas and opinions to determine relevancy.
- D. Contribute to discussions.
- Ask relevant, clarifying questions.
 - Respond with relevant information or opinions to questions asked.
 - Listen to and acknowledge the contributions of others.
 - Facilitate total group participation.
 - Introduce relevant, facilitating information, ideas and opinions to enrich the discussion.
- E. Participate in small and large group discussions and presentations.
- Organize and participate in informal debate around a specific topic.

1.8. Research

- A. Select and refine a topic for research.
- B. Locate information using appropriate sources and strategies.
- C. Organize, summarize and present the main ideas from research.

SCIENCE AND TECHNOLOGY, ENVIRONMENT AND ECOLOGY (Grade 12)

3.2. Inquiry and Design: The nature of science and technology is characterized by applying process knowledge that enables students to become independent learners. These skills include observing, classifying, inferring, predicting, measuring, ... communicating, using space/time relationships, ... raising questions, formulating hypotheses, ... interpreting data, formulating models, designing models, and producing solutions. Everyone can use them to solve real-life problems. ...

3.6. Technology Education: Technology is the application of tools, materials, processes and systems by humans to solve problems and provide benefits to humankind. We use technology in an attempt to improve our environment. These improvements may relate to survival needs (e.g., food, shelter, defense) or they may relate to human aspirations (e.g., knowledge, art, control). They can include unexpected benefits, unexpected costs and unexpected risks. Technology education involves a broad spectrum of knowledge and activities. Effective technology education combines knowledge of content, process and skills to provide students with a holistic approach to learning.

- Analyze biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting. ...
- Analyze specific examples where engineering has impacted society in protection, personal health application or physical enhancement.

3.8. Science, Technology and Human Endeavors: Science, Technology and Scientific knowledge and societal needs often create a demand for new technology. Conversely, Human Endeavors new technology advances scientific knowledge. Both influence society through the impact of their products and processes.

- A. Synthesize and evaluate the interactions and constraints of science and technology on society.
- Evaluate technological developments that have changed the way humans do work and discuss their impacts (e.g., genetically engineered crops).
 - Evaluate socially proposed limitations of scientific research and technological application. ...
- C. Evaluate the consequences and impacts of scientific and technological solutions. ...
- Analyze scientific and technological solutions through the use of risk/benefit analysis.
 - Analyze and communicate the positive or negative impacts that a recent technological invention had on society.
 - Evaluate and describe potential impacts from emerging technologies and the consequences of not keeping abreast of technological advancements (e.g., assessment alternatives, risks, benefits, costs, economic impacts, constraints).

CIVICS AND GOVERNMENT (Grade 12)

5.1 Principles and Documents of Government

- I. Analyze historical examples of the importance of the rule of law explaining the sources, purposes and functions of law.
- J. Analyze how the law promotes the common good and protects individual rights.

5.2 Rights and Responsibilities of Citizenship

- A. Evaluate an individual's civic rights, responsibilities and duties in various governments.
- F. Evaluate how individual rights may conflict with or support the common good.
- G. Evaluate what makes a competent and responsible citizen.

5.3 How Government Works

- D. Evaluate how independent government agencies create, amend and enforce regulations
- G. Evaluate how the government protects or curtails individual rights and analyze the impact of supporting or opposing those rights.

HISTORY (Grade 12)

8.1. Historical Analysis and Skills Development

- A. Evaluate chronological thinking.
- Sequential order of historical narrative
 - Continuity and change
 - Context for events
- D. Synthesize historical research.
- Historical event (time and place)

8.3 United States History

- A. Identify and evaluate the political and cultural contributions of individuals and groups to United States history from 1890 to present.
- B. Identify and evaluate primary documents, material artifacts and historic sites important in United States history from 1890 to present.
- Documents
- C. Evaluate how continuity and change has influenced United States history from 1890 to present.
- Innovations
 - Social Organizations (e.g. technological impact)

HEALTH, SAFETY AND PHYSICAL EDUCATION (Grade 12)

10.1 Concepts of Health

- E. Identify and analyze factors that influence the prevention and control of health problems.
- Research
 - Medical advances
 - Technology
 - Government policies/regulations

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