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 **Activity 1.1.4 Ethical Dilemmas****Purpose**

Biotechnology and its related products raise concerns with many people. Biotechnology applications are often controversial due to the nature of their discovery and development. You should consider personal beliefs and values as you begin your exploration of this field. Is it morally and ethically acceptable to clone plants? Is animal cloning acceptable? Should scientists alter the genes of plants and animals to increase production? How does the science community come to a professional and ethical consensus on controversial topics? Determine your thoughts on each of these and more in this activity.

Materials**Per student:**

- Computer with Internet access
- Pen
- *Agriscience Notebook*

Procedure

In this activity, you will explore your beliefs and concerns related to biotechnical practices. It is important that you understand your personal positions prior to performing applications of biotechnology or discussing the beliefs of others.

Part One – Current Understandings

Your teacher will allow a short period of time to consider your current beliefs and knowledge about eight topics related to biotechnology. On Table 1 on the student worksheet, record your current knowledge and beliefs for each topic as well as any questions you might have about that topic.

Part Two – Developing a Deeper Understanding

Use the remainder of the class period to research each topic further. Using Table 2, record what you have learned in your research and any questions that remain.

Recommended websites for this exploration include the following. You may also want to conduct a quick search of each topic to explore multiple perspectives.

- Bioethics and biotechnology – <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2267612/>
- Biotechnology Industry Organization – www.bio.org
- Biotechnology Information Series – http://www.biotech.iastate.edu/publications/biotech_info_series/
- CorpWatch – <http://www.corpwatch.org/article.php?id=7030>
- Say No to GMO's – http://www.saynotogmos.org/biotech_myths.htm

Part Three – Class Discussion

Prior to discussing the biotechnology topics, consider the following questions individually. Please remember that many viewpoints are a matter of personal values. While you may disagree with others, individuals are entitled to their viewpoints and you should listen to those opinions and respond with professionalism.

- How can emotion cloud scientific research and debate?
- How can you separate personal views from widely-accepted research conclusions?
- How can you discuss a controversial topic without causing harm or offense to others?
- How can you disagree with someone in a respectful, professional way?
- How do personal values affect people's acceptance of a technology?

During the next class period, discuss these questions as a class in order to set ground rules for discussion about controversial topics. Consider how they relate to professional and ethical communication about biotechnology.

Finally, your teacher will facilitate a discussion pertaining to each topic. During discussion, remember to follow the ground rules set during the class discussion to ensure that all students are heard without personal criticism. Sharing ideas, philosophies, and opinions is important in understanding differing viewpoints.

Conclusion

1. How does your background influence your beliefs and opinions about biotechnology?

All my classes that involve agricultural science influence my beliefs and opinions about biotech.

2. Does the practical application of a biotechnical procedure influence your perceptions of that application?

Not really I'm open to anything.

3. What concerns do you have about studying biotechnology?

I don't have any concerns.

1. What biotechnology applications interest you most? **Bioremediation**

Name: _____

Activity 1.1.4 Student Worksheet

Table 1. Current Understandings

	What I Know or Believe	What I Want to Know
Antibiotic use	Fights infections	When were antibiotics discovered?
Embryo transfer	Unknown	What is it?
Animal cloning	Animals with the same DNA	What is it used for?
Plant cloning	Plants with the same DNA	What is it used for?
Genetic engineering	Changing the makeup of something using science	How does genetic engineering work?
Bioremediation	Bio and mediation	What are the types of bioremediation?
Pharming	Unknown	Why is it called Pharming?
Stem cells	Unknown	Are all stem cells the same?

Table 2. Deeper Understandings

	What I Learned	Questions that Remain
Antibiotic use	Were discovered by Alexander Fleming in 1928.	Do all antibiotics work on everyone?
Embryo transfer	When embryos are placed into the uterus of a female with the intent to establish a pregnancy.	How is this beneficial?
Animal cloning	Cloning allows livestock breeders to create an exact genetic copy of an existing animal, especially an identical twin. Clones are superior breeding animals used to produce healthier offspring.	Does this work for all animals?
Plant cloning	Plant hormones are often used to encourage new roots to develop.	Does this work for all plants?
Genetic engineering	The desired gene can be removed from the DNA of the donor organism using enzymes called restriction endonucleases. These are enzymes which chop up DNA strands by cutting them at specific sites, so they can be used to remove very specific genes.	How often is this done?
Bioremediation	Microbial Remediation Phytoremediation Mycoremediation Disaster Response	How do you clean up an oil spill?
Pharming	The process of genetically modifying plants and animals so that they produce substances that may be used as pharmaceuticals.	I still don't understand this.
Stem cells	Stem cells isolated from the sources and tissues are distinct in that they have varying degrees of potency and give rise to differing mature cell types.	I still don't understand this.