



CHANGING ORGAN DONATION WITH BIOTECHNOLOGY

Scientific and technological advances in life science inevitably raise questions about ethics. These advances, especially those involving the editing of DNA, provide ideal opportunities to explore the world of bioethics with students and to encourage students to research these advances and decide how they themselves feel about them.

NOTE: This activity can be used as a standalone or in combination with the ABE pocket lesson [Designing Babies with CRISPR](#).

Brief Description

In this activity, students explore the need for innovative solutions to the shortage of transplantable organs and how gene editing technologies might offer a potential solution.

Duration of the Lesson: 2–3 50-minute class periods

NOTE: Where you break the lesson is up to you based on what best fits your class schedule and student progress. For example, you may find you want more time for discussion and debate, which could equate to three class periods.

Learning Objectives

Students will be able to:

- Discuss how medical advances address societal needs for organ donors
- Evaluate a media source for credibility
- Identify the risks and benefits of possible organ transplantations used from outside human donors
- Use evidence to defend their opinion about xenotransplantation

Preparation

- To ensure a productive debate, review **Teacher Resource 1**. It is a great primer for setting up a debate in your classroom, especially how to navigate potentially sensitive topics and topics that have the possibility of inequity or unintended consequences.

NOTE: All teacher resources and student readings are accessible from the **Resources list**.

- Explore how to support students as they develop their claims, evidence, and reasoning. **Teacher Resource 2** is a good place to start.

RESOURCES

Readings:

- **Student Reading 1:** [Complete Guide to Debating: How to Improve Your Debating Skills](#), Gini Bequiri, VirtualSpeech
- **Student Reading 2:** [Eyeing Organs for Human Transplants, Companies Unveil the Most Extensively Gene-Edited Pigs Yet](#), Kelly Servick, AAAS Science
- **Student Reading 3:** [Conducting a Debate](#), Government of Manitoba (Canada)
- **Student Reading 4:** [A Brief History of Cross-Species Organ Transplantation](#), David K. C. Cooper, National Center for Biotechnology Education
- **Teacher Resource 1:** [3 Steps to Civil Discourse in the Classroom](#), National Council for Social Studies
- **Teacher Resource 2:** [How Can You Use the C-E-R Format to Engage Students in Arguing from Evidence?](#), iExploreScience

Data:

- U.S. Health and Human Services
 - [Organ Procurement and Transplantation Network \(OPTN\) Data](#)
 - [OPTN National Data Reports](#)
 - [The Living Donation Process](#)
- [International Registry of Organ Donation and Transplantation \(IRODaT\)](#)
- [Global Observatory on Donation and Transplantation \(GODT\)](#)

- Before beginning this pocket lesson, have students read **Student Reading 1**, paying special attention to the Basic Argument Structure and Rebuttal sections.

Teaching Sequence

Part One

ENGAGE

1. Ask students if they know of any issues that affect organ transplantation. Many students will recognize that there are not enough organs available for transplantation. Students may know of someone who needs or received an organ transplant; the subject may be a sensitive one.
2. Survey the class by asking, “How many people do you think are waiting for an organ transplant of any kind?” Listen to student responses and create a quick chart of “fewer than 1,000,” “1,000–5,000,” and “more than 5,000,” and tally students’ responses.
3. Probe students’ awareness of the issues by asking, “Have you seen or heard any news stories about research into solving the organ transplantation problem?” Students may or may not know of such research. Students may suggest some of the following:
 - o The use of living donors
 - o The development of artificial organs (e.g., a mechanical heart)
 - o Growing organs in the lab
 - o Growing organs in other animal species
4. Explain that there are organizations in most countries responsible for ensuring that human organs are distributed fairly because there are not enough organs available to meet the need. In this lesson, students will explore the need for organ transplantation and how organs are allocated.
5. Have students break into small groups of two or three students to explore organ transplant lists. You can direct students to the links listed in the Resources list or have them investigate on their own. Students should answer the following questions:
 - o How many people in our country/region are awaiting organ transplants?
 - o [If students are able to find waiting times for transplants] How long, on average, do people have to wait for organ transplants? Do some organs have longer wait times? If so, which ones?
 - o What is the process by which donors and recipients are matched?
 - o What information here surprises you?
6. Discuss solutions to the issue of long wait lists and organ shortages.

7. Students may suggest that living donors can help solve the problem. If so, probe their thinking by asking them how they might feel about providing an organ to transplant.

TEACHER TIP: This is a potentially troubling discussion, and it might be best to simply suggest that it could be difficult to give up an organ. Students may also suggest that we develop machines that could replace organs (e.g., the artificial heart).

8. Direct students to read **Student Reading 2**. Teams may read silently or aloud.
9. Tell students it is important to consider the source of what they are reading and identify the piece as an article from a reputable source and writer, an opinion piece, or a research study. Keeping this in mind will help to inform the reason why the article was written. For more guidance on assisting students with validating a source, visit the ABE blog post [Seeing Is Not Necessarily Believing](#).

EXPLORE

10. Explain to students that they will be debating the use of pig-grown organs for transplants. One half of the class will take on the role of a family whose young daughter needs a kidney transplant and might be cured with a pig-grown transplant. The other half of the class will take on the role of animal-rights activists. The two sides will research evidence to support their positions about the ethics of this procedure. As an alternative, you can break students into smaller groups of four or five students and give them each a side to debate (i.e., a parent in need of a transplant for their daughter or an animal-rights activist).
11. Direct students to **Student Reading 3** to learn more about how their debate will be conducted. Teams may read silently or aloud. Explain that in this debate, you will be acting as the judge. If needed, this can also be assigned as homework in preparation for the next class period.

Part Two

12. Remind students of their roles in the debate. To begin their research, have students read **Student Reading 4** and discuss. The following questions may help them consider their own positions on the matter:
 - o If you needed an organ transplant, would you want to receive a “custom” organ grown specifically for you inside a non-human animal? Why or why not?
 - o To what extent is an animal with some human cells a person?
 - o To what extent should we be able to experiment on animals to harvest organs? Is it ethical to do this given that it is impossible for them to agree to the research and genetic modifications being made?
 - o Ethically, do you believe there is a difference between sacrificing a pig for its meat and sacrificing it for an organ transplant?

13. Explain that each team should choose two students to direct the team's work, three to be speakers, one to manage and ensure that the tasks are being completed, and the rest to research and write. Adjust the roles if you have chosen to have smaller debate teams. Each student on the team should have a defined role.
14. Give students the remainder of the class period and the following period to conduct their research. Remind them that they should be using Claim-Evidence-Reasoning to structure their arguments.
15. Hold the debate, being careful to monitor the classroom climate and foster civil dialogue.

DISCUSS

16. Have a brief whole-class discussion, asking some students to give their feedback on the debate. Ask students:
 - o Do you think that the teams followed the rules of the debate?
 - o Do you feel that teams supported their claims with evidence and explained their reasoning adequately?
17. Ask if the debate changed the way they initially viewed the topic and whether they feel differently about their initial position on the topic.