DESIGNING BABIES WITH CRISPR

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 pocket lesson or in combination with the ABE pocket lesson *Changing Organ Donation with Biotechnology*, which should be used first.

Brief Description

In this activity, students read and analyze an article exploring the process of genetic modification and the implications it can have on society. Students explore the ethics of editing embryos with CRISPR technology.

Duration of the Lesson: 1–2 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. Depending on the amount of time you would like students to spend writing their newspaper opinion pieces, you may find that you will need an additional class period.

Learning Objectives

Students will be able to:

- Discuss the implications (both negative and positive) of using CRISPR technology on embryos
- Identify the risks and benefits of using CRISPR in human medical research
- Describe the process by which a scientist developed a "CRISPR baby"
- Evaluate and defend their opinions about human genetic modification

RESOURCES

Reading:

- **Student Reading 1:** CRISPR'd Babies: Human Germline Genome Editing in the 'He Jiankui Affair' (pp. 1–9), Henry T. Greely, *Journal of Law and the Biosciences*

Data:

- Data tables from Global Observatory on Donation and Transplantation (GODT) (Note: Only needed if you have already covered *Changing Organ Donation with Biotechnology*)

Teaching Sequence

ENGAGE

1. If students have already covered *Changing Organ Donation with Biotechnology*, have them, as a class, generate some pros and cons of using CRISPR technology for organ transplantation. Ask them if they think there are any considerations that need to be made going forward, by either the government or researchers, knowing how quickly technology develops. You can also use the data tables (accessible from the Resources list) to provide an illustration of the number of people who have received transplants and are on the transplant list for specific organs.
2. If students have not covered *Changing Organ Donation with Biotechnology*, begin by asking students whether they would agree to a treatment to eradicate genetic diseases in children if it meant scientists could also create genetically edited humans? Let students share their opinions and why they feel that way.
3. Have students read **Student Reading 1** (accessible from the Resources list). Teams may read silently or aloud.
4. After considering the source of the article and its purpose, pose the following questions to the class:
    - What is the main message of the article? *Student answers will vary but may include that the author argues that while CRISPR technology may be powerful, it should be used with caution. A robust code of ethics should be developed, put into practice, and supported by law immediately to ensure CRISPR technology is used to benefit humans rather than merely becoming a profit-generating tool.*
    - What are some of the arguments used to support this message? *Student answers will vary but may include that the author mentions repeatedly how little concrete evidence exists to prove that Dr. He did, in fact, edit human germline cells of one set of twin girls. Even if he did, the experiment was kept secret for some time, and the author argues that this lack of transparency surrounding the research bodes ill for future ethical use of CRISPR technology.*
    - What do you think is the writer's attitude toward the use of CRISPR to "manufacture" babies? *Student answers will vary but may include that the author likely would be against the "manufacturing" of babies, unless new oversights and ethical guidelines were to be implemented. However, the writer does mention the use of CRISPR technology to eliminate certain genetic diseases, and appears to be in favor of this approach.*

5. Ask students to then consider whether the benefit of genetic tools, such as CRISPR, outweigh the risks. *Students may mention some of the following risks and benefits:*
    - *Possible risks: Selecting the genetic makeup of future children, which may give people the power to control some personal traits, such as having blond hair or being tall. Taken to an extreme, this could eliminate some traits and even endanger humanity (e.g., if only male embryos are born).*
    - *Possible benefits: Eliminating genetic diseases. For example, geneticists think it may be possible to eliminate genetic diseases such as Tay-Sachs through careful and methodical screening programs.*

EXPLORE

6. Have students write a newspaper opinion piece about their views on one or more of the ethical issues related to using CRISPR to design babies. If students struggle with choosing an ethical issue to write about, you can provide them with one of the prompts under "Extensions" below to help them get started.

DISCUSS

7. Ask students if their opinions and perspectives have changed throughout the lesson. What was the biggest contributing factor to these changes? Was anything they learned particularly surprising? What regulations do they think should be put in place to ensure ethical use of gene editing technologies? Why?

EXTENSIONS

Have students write position papers or participate in debates about the following scenarios:

- It took scientists 277 attempts to clone a normal, healthy sheep (Dolly) in 1996. But what happened to the other 276 sheep? Have students research these previous attempts. What do they think would happen if it took 277 attempts to clone a human being? What does this information tell us about the consequences of cloning?
- Scientists have experimented with growing replacement human parts on animals, such as mice. One example is the Vacanti mouse, on whose back scientists grew an outer ear. Research this practice and prepare an argument about whether or not this practice is ethically sound.