



# The Future of Babymaking

## Lesson Plan

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This Lesson Plan accompanies Episode 9, Season 1 of *playing god?*

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## Table of Contents

<b>Summary</b>	<b>2</b>
<b>Vocabulary</b>	<b>3-4</b>
<b>Discussion Guide</b>	<b>5-6</b>
<b>Sample Activities</b>	<b>7-8</b>
Consider the Ethics	7-8
Research & Writing	8
<b>Additional Resources</b>	<b>9</b>
<b>Careers Mentioned</b>	<b>9</b>
<b>About This Lesson Plan</b>	<b>10</b>

## Summary

This Episode takes students into the future to learn about a controversial technology under development that could revolutionize the way humans make babies. Using in vitro gametogenesis (IVG), researchers are attempting to reprogram human cells—like a skin cell—to become eggs or sperm. With IVG, anyone could produce their own eggs or sperm in virtually unlimited quantities, opening new possibilities for human reproduction. When would it be ethically acceptable to use the sperm and/or eggs created by IVG to make a baby? How can societies ensure the technology is used ethically and properly regulated?

This Lesson Plan will help students anticipate ethical dilemmas that might arise from a technology that is still under development. Students will evaluate and critique the ethics considerations covered in the Episode and articulate their own answers to the ethics questions that arise.

# Vocabulary

The following are key terms used in the Episode and their definitions. The terms are marked in bold when they appear elsewhere in the Lesson Plan.

## Assisted Reproductive Technologies

Medical procedures involving gametes used to treat **infertility** and help individuals or couples conceive a child.

## First-in-human

The experimental use of a medical technology or treatment in humans, when it has previously only been tested in non-human models.

## Food & Drug Administration (FDA)

The United States government agency that is responsible for regulating drugs, medical products, and devices, making sure they are safe and that they work (efficacy). It is also responsible for the regulation of cosmetics, food products, and radioactive products.

## Genetic Abnormalities

A change in the genome that deviates from what is considered typical.

→ If an embryo has **genetic abnormalities**, it may fail to develop, or, if it does develop, the resulting human may have genetic disease.

## Genetic Parentage

When a parent has a biological connection to a child, established by the contribution of the parent's genetic material to the child. Sometimes referred to as biological parentage.

## Gestational Carrier/Surrogate

A gestational carrier or gestational surrogate is someone who carries a pregnancy for someone else and does not have a genetic connection to the resulting baby.

## Infertility

A disease or condition in which someone is unable to become pregnant or carry a pregnancy to term. **Social infertility**, defined below, is one type of **infertility**.

## Informed Consent

Ethical and legal standards require **informed consent** in medical decision making and when agreeing to participate in research. In medicine, informed consent requires “a discussion of the nature of the procedure, the risks and benefits, the reasonable alternatives, and an assessment of the patients’ understanding of these items.”<sup>1</sup>

## Menopause

The end of menstruation, which typically marks the end of the person’s ability to become pregnant.

## Parity

Being equal or equivalent.

→ IVG would result in **parity** between heterosexual and same sex couples’ ability to become **genetic parents** to their child, because both parents could contribute gametes.

## Social Infertility

When individuals are not able to reproduce for social reasons rather than reasons of a medical disease or disorder. The term applies to the challenges experienced by single individuals and same-sex partners in conceiving a child.

→ Professor Glenn Cohen has also described this as “disfertility” in the Episode.

# Discussion Guide

The following Assessment Questions can be used by instructors to evaluate student comprehension of Andrea's story and the bioethics concepts featured in the Podcast Episode. The Discussion Questions can prompt students to make claims and provide evidence and their reasoning. Student comprehension and views can be assessed before and after listening to the Episode and/or participating in the group activity.

## Assessment Questions

- How does in vitro gametogenesis (IVG) work? What materials does it start with? What does it create?
  - *Answer: In vitro gametogenesis (IVG) can take a somatic cell and use it to create stem cells that are then grown to become **gametes**.*
- What stage of research is IVG in?
  - *Answer: IVG is in the “pre-clinical” phase of research. This means it has not been tested for use in humans.*
  - Have any babies been born using IVG? *Answer: No.*
- What are some of the risks of IVG that bioethicists, scientists, physicians, policymakers and others are worried about? *Sample answers provided.*
  - *When to try **first-in-human** IVG: how will we know when this technology is safe enough to test in humans (make a human using IVG gametes) for the first time? What will that experiment look like? Will we need to study **intergenerational** effects?*
  - *Access: who should have access to this technology if it becomes available? For what reasons? Who should not? Who will be able to afford it?*
  - ***Informed consent**: How can we make sure that the people whose cells might be used for IVG are well informed and freely choose to participate? And, if we study **intergenerational** effects, how do we respect the wishes of the people who would be born using IVG, who did not and could not **consent** to being born this way?*
- What would the benefits of this technology be for people who want to become parents? *Sample answers provided.*
  - *IVG could be used as a treatment for **infertility**.*
  - *IVG would create more reproductive choices for those who are fertile.*
  - *It is a new **assisted reproductive technology** that can result in **genetic parentage**.*
  - *People who are **socially infertile** would have options that are more similar to those of fertile people.*

- *It would be less invasive to collect any cell for IVG than other **assisted reproductive technologies**, like egg retrieval.*
- *It might reduce the social and legal complications of using egg or sperm donors.*

## Discussion Questions

Professor Glenn Cohen uses new terminology to apply to IVG debates. Notably, “mimicking” uses and “extending” uses.

- What does Prof. Cohen mean by a “mimicking” use of IVG?
  - *Prof. Cohen defines mimicking uses as enabling people to do something that they would ordinarily be able to do, if not for a medical issue.*
  - *An example is transplanting an organ that is not performing its function.*
- What does he mean by an “extending” use of IVG?
  - *Prof. Cohen defines extending uses as an attempt to give people the ability to do something that other similarly situated people are not able to do.*
  - *An example is the extension of the typical female reproductive period beyond **menopause**.*
- What is the difference between “mimicking” and “extending” uses of IVG? Think back to Prof. Cohen’s explanations– what does he say is the difference– and think of some examples for each.
  - Why does he make this distinction? Do you think these distinctions are helpful when thinking about who should have access to IVG?
- Who should have access to IVG technology if it becomes available? *Example uses below.*
  - *People with **infertility** from a medical disease or disorder*
  - *Same sex couples*
  - *Older people, who are past the age of fertility*
  - *Someone who wants to create sperm and eggs from their own cells (one parent)*
  - *Someone who wants to parent a child with their deceased spouse*
  - *People who want to delay becoming parents until a time of their choosing*

# Sample Activities

The activities allow students to actively engage with the bioethics questions at the center of the Episode. Students will develop critical thinking skills and reason-based judgment by citing evidence from the Podcast and other sources. In bioethics, there often isn't a single "right" answer to a particular question; ideally, students will express and evaluate diverse viewpoints about complex, real-world problems.

## Large Group Activity: Consider the Ethics

### Description:

This activity encourages students to discuss the ethics of IVG before hearing from the bioethicist in the Episode. Students will work together in small groups to discuss issues and articulate viewpoints. The class can also brainstorm ways to reconcile differing viewpoints when making decisions about a new technology. This can be done before the students listen to the ethicist in the Episode, and they can compare their class discussion to the discussion in the Podcast.

### Instructions:

*Before the Activity:* Students should listen to the Podcast Episode from the beginning to 16:41. Below are the ethics questions that are introduced at the end of this segment.

*During the Activity:* Divide students into small groups (3-5 people). Within each group, one person will be the designated note-taker, who will report the group's conclusions back to the class. Another person will serve as the facilitator/timekeeper, who can keep the group discussion on track.

Below are the ethics questions introduced at the end of the Podcast segment. Groups can take 10 minutes to discuss the first set of questions and then regroup and report to the class. Repeat this process for the second and third set of questions.

1. "What do we have to do to perfect this technology? Does it involve of a lot of embryos destruction along the way, and is that a problem? How will we know when this is safe and effective and ready for human use? And when do we move to testing IVG in humans? first-in-human?"
2. "How will we know what the intergenerational effects might be, and how do we track that? And can we actually demand to have data from successive generations – people who never consented, for example, to this because they were born this way?"

3. “And then maybe finally is just a broader question about whether this is a worthwhile goal for humanity, especially when we have so many people with other kinds of medical needs. Is this really where we should be spending our time, spending our money, and spending our research effort?”

Finally, as a class, brainstorm answers to the following questions.

- Were there any differences that came up between groups in the class?
- How can we make sure different opinions are heard and respected when we develop a new technology like IVG?

## Individual Activity: Research & Writing

“The future is already here. It's just not very evenly distributed.” - William Gibson

Pick a healthcare technology and examine it in the context of this statement. What is the technology and how does it work? What are the benefits? Who has access to this technology and who does not? What factors determine access? In your opinion, have the benefits of the technology been evenly and fairly distributed? Suggest changes that could be made to make sure this technology is evenly and fairly accessible by everyone.

*Examples of recent technologies:*

- *COVID vaccines*
- *Telehealth*
- *Other **assisted reproductive technologies***
- *Gene therapies for diseases like sickle cell disease, spinal muscular atrophy (SMA, see Episode 8)*
- *Prosthetic limbs*
- *Mobility devices– power wheelchairs, accessible vehicles*
- *Communication devices– brain-machine interfaces*



# Additional Resources

Further readings about key topics covered in the Episode.

[Creating a sperm or egg from any cell? Reproduction revolution on the horizon](#), NPR, 2023.

[In-vitro gametogenesis: New technology could revolutionize reproductive options](#), CBS News (YouTube), 2023.

[The Promise and Peril of Emerging Reproductive Technologies](#), The Petrie Flom Center News, 2017.

[Is there a valid ethical objection to the clinical use of in vitro-derived gametes?](#) Reproduction & Fertility, 2021.

[In vitro gametogenesis: just another way to have a baby?](#) Journal of Law & the Biosciences, 2023.

## Careers Mentioned

### Professor:

Glenn Cohen, JD (bioethics and law)

Amander Clark, PhD (molecular cell and developmental biology)

### Bioethicist:

Glenn Cohen, JD

### Researcher:

Amander Clark, PhD

# About This Lesson Plan

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*The Podcast Episode and this Lesson Plan are not designed to answer patient-specific clinical, professional, legal, or ethical questions. Information contained herein is not intended as a substitute for professional consultation.*

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<sup>1</sup> Shah P, Thornton I, Turrin D, Hipskind JE. "Informed Consent." 2023 Jun 5. In: StatPearls. Treasure Island (FL): StatPearls Publishing.