Ethics Role-Play Kit: Who Decides What Goes in the Soil?

Introduction

A 60-minute role-play in which participants argue for or against the field release of a hypothetical engineered soil bacterium in an extended conversation and then vote depending on their role. This activity doesn't require previous biology knowledge or experience in the lab and can be adapted to any iGEM idea or synthetic biology idea.

	Detail
Audience	Ages 15+: secondary school, university, researchers, general public
Group size	8–32 people, in groups of 4 (one per role, or even more than group acting as the same role once all of them are at least covered once)
Duration	60 min (a 40-min version can be found in Adaptations)
Prior knowledge	None for participants; organisers should read the Information section
Cost	Printing only (about 1 page per participant)

Learning objectives

By the end of the session, participants will be able to:

1. Explain in one sentence what an engineered microorganism is and why someone might release one into the environment.
2. Name at least two benefits and two risks of releasing a genetically modified microbe into soil.
3. Describe how the same decision looks from the side of a consumer, a regulator, a farmer and a scientist.
4. Recognise that deciding about new biotechnology is a social choice and that the general public has a say in it.
5. State their own position and justify it with at least one reason they heard or thought about during the discussion.

Information for organisers

You only need to understand five general ideas to run the session well, even if you are not a biologist. However, it is advisable to have more knowledge about ethics in synthetic biology to be able to answer possible questions from the audience or conduct the conversation in a responsible and structured way. This can be achieved by non-expert people who do a bit of research while organising the event.

Key terms for the session (example from the ones important for our project):

- **Synthetic biology** designs and builds new functions in living cells, much as an engineer designs a circuit or programs a laptop. Scientists work in cycles: design, build, test, learn.
- **Soil microbes** live around plant roots and can help plants take up water and nutrients. Some can be engineered to do this better, for example to help crops survive drought.
- **Why it is debated:** a microbe released into a field cannot be fully recalled. Open questions include whether it spreads beyond the field, whether it passes its new genes to other bacteria and how it affects the organisms already living in the soil.
- **Safeguards exist but are not perfect:** scientists can build in "kill switches" (mechanisms that automatically kill the bacteria if it gets out of the area it was designed to be in) or make the microbe dependent on a nutrient only found in the field. Unfortunately, none of these is 100% reliable.
- **Regulation:** in the EU, releasing a genetically modified organism into the environment requires a case-by-case risk assessment and approval (Directive 2001/18/EC). Work inside a lab falls under separate, lighter rules. For this part, it might be useful to research the specific laws that are applied in your country, to better inform the audience you will be working with!

Even if there is a lot of previous research for the session, you might encounter a participant asking something you cannot answer, which is an essential step! Write it on the board as an open question.

Materials and preparation

Everything can be printed on plain paper and the setup takes about 15 minutes.

- Print 1 scenario card per group
- Print 1 set of 4 role cards per group (cut apart)
- Print 1 pre/post question sheet per participant (see Evaluation)
- Board or flipchart with three columns: *Benefits*, *Risks*, *Open questions*
- Voting cards or sticky notes in three colours: *Approve*, *Approve with conditions*, *Reject*
- Timer visible to everyone
- Arrange tables in groups of 4 before people arrive

This activity can also be done online, with each paper converted into a pdf or using a general presentation.

Session plan (60 min)

One of the aims of this session is to move from individual opinion, to arguing someone else's view, to a shared decision, so participants hear perspectives they would not have raised themselves.

Time	Step	What the organiser does
0–5 min	Pre-questions	Hand out the pre/post sheet, so participants can answer the *Before* questions only.
5–12 min	Hook and context	Ask: "If a bacterium could save a farmer's harvest in a drought, would you let it loose in a field?" Take 3–4 quick answers. Explain the five background ideas in plain words.
12–17 min	Scenario and roles	Read the scenario card aloud. Hand each person a role card randomly so they can read it.
17–27 min	Prepare	Everyone with the same role meets across groups (all Regulators together, etc.) to build their 2–3 strongest arguments.
27–42 min	Council debate	Each group must open a debate between their members and reach one decision regarding the presented dilemma. The organiser can act as a guide in this step.

Time	Step	What the organiser does
42–47 min	Vote	Each group reports its decision in 30 seconds. After doing so, everyone loses their role and votes again, but as themselves, not the assigned role.
47–57 min	Debrief	Step out of roles. Use the debrief questions below and fill the Benefits / Risks / Open questions board with the room.
57–60 min	Post-questions	Participants answer the *After* questions and the feedback item.

Notes on this schedule:

- Keeping the debrief is essential even if you run short on time because it is where role-play turns into learning.
- This plan is for Scenario B. Scenario A uses a shorter whole-room format, described with its cards; the pre/post questions and debrief work with both.

Scenarios and role cards

This kit includes two worked scenarios created by our team using the same four roles, so organisers can see how the format transfers between topics. Pick one scenario per session or imagine your own! Both scenarios are fictional on purpose, so no one defends a real product.

Scenario A: The drought council

The story presented:

“The drought council. After three dry summers, farms in a Mediterranean region are losing a third of their harvest. A young biotech company has engineered a soil bacterium that lives around plant roots and helps crops hold on to water. Field trials in closed greenhouses worked. The company now asks the regional council for permission to release it on 50 farms for one

season. Your group is the council. By the end, you must decide: approve, approve with conditions, or reject, and explain why."

Role cards for Scenario A

Role 1: Consumer

You buy food for your family at the local market. You want affordable, local produce and you worry about prices rising after bad harvests. You also want to know what is in your food and whether anything "engineered" ends up on your plate.

Questions to think about: Would you want this labelled? Who would you trust to tell you it is safe? What would make you refuse to buy it?

Role 2: Regulator

You work for the agency that must approve or reject releases of genetically modified organisms. Your job is to protect people and the environment, using evidence. You cannot approve something just because it is useful and you cannot reject something just because it is new.

Questions to think about: What evidence would you need first? What conditions or monitoring would you require? Who is responsible if something goes wrong?

Role 3: Farmer and agronomy expert

You manage a family farm and advise other farmers. Drought is costing you money every year and some neighbours are thinking of giving up. You know soil well and you have seen promised solutions fail before.

Questions to think about: How much would it cost you? What if it spreads to a neighbour who did not want it? What would convince you it works outside a greenhouse?

Role 4: Synthetic biology scientist

You helped design the bacterium. You believe it could help farmers adapt to climate change and you know its limits better than anyone. Your reputation depends on being honest about both.

Questions to think about: What safeguards did you build in, and how reliable are they? What do you still not know? What would you say to someone who is simply afraid of it?

Debrief questions

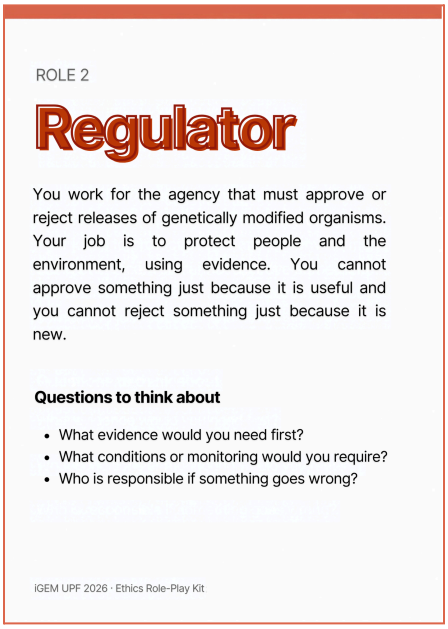
Pick 4 or 5 and always ask the first and the last.

1. Did your personal vote differ from the decision your role argued for? Why?
2. Which argument from another role surprised you or changed your mind?

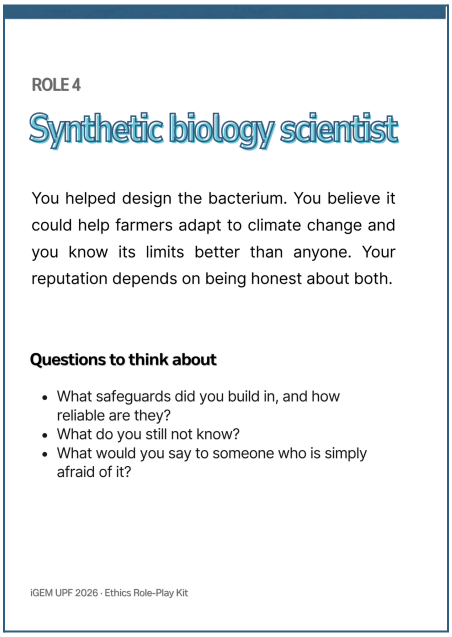
3. Which risk felt most serious, and could any safeguard fully remove it?
4. Who was *not* at the table but should have a say (neighbouring farmers, future generations, other countries, the soil ecosystem itself)?
5. Is "we don't know yet" a reason to wait, or a reason to test carefully?
6. Would your answer change if the crop were food for a hospital, or grapes for wine, or cotton?
7. What would you want to ask a real scientist or regulator after today?

Possible cards design:









Scenario B: Same technology, different chair

First run at the PRBB with researchers at the end of one of our talks there. This was adapted to be faster than the previous scenario and is thought to be done in a whole-room format, taking around 30 minutes and without having small groups.

How it runs

1. Divide the room into the four roles (or let everyone play each role in turn).
2. For one role at a time, read its context aloud, then its questions one by one.
3. After each question, everyone playing that role takes a position: right side of the room for *yes*, left for *no* (you can also skip this by just asking people to put their hand up whenever they agree or not).
4. Always ask at least one person on each side why they chose it. Without the why, there is no dialogue.
5. Finish all of a role's questions before moving to the next role. Feel free to improvise the context or reword the questions.

The story presented:

"In a Mediterranean wine region, summers are getting hotter and drier. Some vineyards have lost a large part of their harvest in recent years, and winegrowers who have farmed the same land for generations are wondering how long they can keep going. Irrigating is expensive and in many places water is already rationed. A genetically modified soil bacterium has been developed to help grapevines withstand drought. The plant itself is not modified, only the microbes living around its roots. The bacterium has a built-in kill switch so that it dies if it leaves the roots. Should it be used in vineyards?"

Role cards for Scenario B

Role 1: Consumer

Assume you enjoy wine or grapes at New Year's Eve. They come from a nearby cellar with a protected designation of origin and high standards. One day you read the label and see the vines grew alongside a genetically modified microorganism: not the plant, only the microbes around its roots.

- Would you still trust it? Would you drink it without worrying?
- Would you feel differently about eating the raw grapes?
- What would put your mind at rest? Do you think there would be more or less oversight of this product?

Role 2: Regulator

You make sure that everything reaching the final user is safe and legal, and that the drawbacks do not outweigh the benefits. You probably work for the government and see thousands of promising projects a year.

- Should genetically modified microorganisms be assessed case by case rather than under a single framework?
- Should genetically modified microorganisms be regulated differently from genetically modified plants?
- Is current regulation too strict? What would you change?

Note for the organiser: in the EU, releasing any genetically modified organism into the environment, microbes included, needs case-by-case authorisation (Directive 2001/18/EC). New EU rules for gene-edited plants (the NGT regulation, applying from 2028) treat some plants with fewer than 20 small edits like conventional ones, but they cover plants only, not microorganisms. Check the current status of these laws before each session.

Role 3: Farmer and agronomy expert

Every summer, heat and months without rain leave your vines struggling. Now a genetically modified bacterium, something you had never heard of, could help them withstand drought and it has passed every safety assessment the authorities require.

- Would you buy it?
- You are unsure: "GMO" sounds like science fiction. If you were told it does not modify your vines, only the microbes in the soil, would you feel more comfortable?
- You try it and your harvest is saved. Months later a customer at the market asks: "Is this wine natural?" Nothing was done to the vine itself. Would you worry about keeping your designation of origin or losing customers who value traditional wine?

Role 4: Synthetic biology scientist

You studied biology, found synthetic biology was your passion and did a PhD in it. You are now the expert, even if everything you know is what you heard today.

- Would you be comfortable selling this product to farmers? Do you believe it is safe? How would you defend it?
- Do you feel you need more information on each of these? Take a position for each: how the bacterium works, how its safety is assessed, its possible environmental impact, who regulates it and its potential benefits.
- Should genetically modified microorganisms be assessed case by case, and regulated differently from genetically modified plants?

Everyone, each in their role

- Would your role allow this bacterium in the field?
- Would your role drink this wine or eat these grapes?
- Would your role support more flexible testing spaces (regulatory sandboxes) to see where this technology can go?

Final step: out of role

Everyone stands in one line (this can also be done with a poll in the screen): right for *yes*, left for *no*. Ask: "Have you learned something from this session?" Ask two or three people what. If anyone is on the left, ask what they would improve. Finally: "Would you have answered differently in another role?"

Possible adaptations

Situation	Change
Only 40 minutes	Skip the cross-group preparation.
Ages 12–14	Replace the regulator's legal framing with "the person who makes the rules"; use simpler questions and explain the hard concepts taking enough time for everyone to understand.
Researchers or university students	Add a fifth role: an environmental NGO. Ask them to propose monitoring conditions in detail.
Online	Use breakout rooms of 4, share role cards privately in chat and vote with a poll.
More than 4 per group	Double up roles.
Low vision or reading difficulties	Read role cards aloud, offer large-print cards (18 pt) and let people answer the survey verbally.

Evaluation

Ask the same three questions before and after, so you can show what changed because of the learned material during your activity.

Before and after (same wording both times):

1. How well could you explain what an engineered microorganism is? (1 = not at all, 5 = very well)
2. Should engineered microbes be allowed in open fields? (Yes / Yes, with conditions / No / Not sure)
3. How much do you feel people like you should have a say in these decisions? (1 = none, 5 = a lot)

After only:

4. One argument you heard today that you had not considered before.
5. One thing you would change about this activity.

How to use the results:

- Compare the before/after answers for questions 1–3 and report the shift (for example, "average score on Q1 rose from 2.1 to 3.8, n = 24").
- Group the answers to question 4 by role, to see which perspectives were new to people.

Build your own role-play from any iGEM project

Any iGEM project, or synbio idea, can be adapted for this activity in about two hours of preparation. The process is simple: turn the technology into a decision, then give that decision to four people with real stakes.

Here is a list of ideas and tips for building this activity efficiently:

1. **Start from the decision:** ask what yes/no choice society would face if your project worked: release it, give it to patients, sell it, fund it, ban it.
2. **Make it hypothetical:** use a fictional company, place and organism one step removed from your own project. Participants then can debate the question freely instead of judging your team (this specially helps because you avoid people having to agree with you just because you are there explaining you own project), and the activity stays as Education rather than Human Practices.
3. **Pick four roles with different stakes:** someone who benefits, someone who carries the risk, someone who decides and someone who knows the technology. Swap in a voice that is usually missing when you can, since roles can vary depending on the technology of your project.
4. **Write each role card in the same shape:** who they are, what they want, what they fear and three questions to think about. Give every role at least one strong argument because the most important part of this activity is for everyone to know that no role is the villain.
5. **Build in a real trade-off:** the benefit should be urgent and the risk uncertain, and the group must choose between approve, approve with conditions, or reject.

Some examples of what you might do, depending on the type of your project:

Project type	Decision to debate	Benefits	Carries the risk	Decides	Knows the technology
Engineered probiotic therapy	Should a hospital offer a living-bacteria treatment before long-term data exist?	Patient (but with associated risk; for this example, you may have two groups of the role patient)	Patient	Hospital ethics committee	Scientist
Whole-cell biosensor	Should a town rely on an engineered-cell water test instead of lab analysis?	Resident	Resident and town budget	Water authority	Scientist or lab technician
Precision-fermented food	Should a school canteen serve milk protein made by engineered yeast?	School budget	Student and local dairy farmer	Food safety agency	Scientist
Environmental release (this kit)	Should an engineered soil bacterium be released on farms?	Farmer	Consumer and neighbouring farms	Regulator	Scientist

Finally, remember that this is not a closed design and you can decide whether to add or eliminate any part to suit better the activity you want to carry on. If you run or improve this activity, we would love to hear what worked and what you changed. Happy Education! Contact: igem@upf.edu