Build It With Us, a challenge-based talk Kit

Introduction

“Build It With Us” is a talk format in which the audience designs your iGEM project before you show it to them. You split the project into the design decisions your team faced and pose each one as an open challenge. The audience proposes answers, you discuss them together and only then do you reveal what your team chose and why, making clear that it was one reasonable option and not the only correct one.

The format works because people remember what they reason out for themselves and because it shows how synthetic biology is really done: a chain of decisions under constraints. Any iGEM team can adapt it to its own project and it needs no lab materials.

We ran it at Centre Cívic Guinardó (Barcelona) on 14 October 2026 with an adult audience, most of them over 65 and outside science. Our results and lessons are at the end of this kit.

	Recommendation
Audience	Adults or older teenagers with no science background.
Group size	10 to 30 people, small enough for everyone to speak.
Duration	70 to 90 min (our session was around 60 minutes and attendees asked for more time).
Organizers	At least two, so one leads the challenges, while the other writes the audience's ideas on the board.
Materials	Projector and slides, a whiteboard or flipchart and the questionnaires (QR code or printed).
Preparation	Around half a day to design the challenges and rehearse the reveals.

Here is what you will find in this kit:

1. Step 1: Break your project into design decisions.
2. Step 2: Turn each decision into a challenge.
3. Step 3: The reveal.
4. Session structure and timing.

5. Organiser tips.
6. Measuring impact: pre and post questionnaires.
7. What we learned running it.

Step 1: Break your project into design decisions

List the decisions your team had to make in the order you made them. Aim for four to six. Keep only decisions an audience can reason about with everyday knowledge, leaving things like cloning strategies and part numbers out.

Most iGEM projects share the same structure at the beginning, so start with these questions and keep the ones that apply to you:

1. **The problem:** out of everything that is wrong, what exactly are you trying to fix?
2. **The function:** what new ability does your organism or product need to fix it?
3. **The trigger:** what tells it when to act and why not simply act all the time?
4. **The risks:** what has to be true before it can leave the lab?
5. **The conversation:** who needs to be consulted before it reaches the real world?

For each decision, write down the answer your team chose and the one or two reasons behind it. Those notes are the reveals you will give in Step 3.

Step 2: Turn each decision into a challenge

A good challenge is a short scenario with a constraint. It should allow several defensible answers, use no difficult words and fit on one slide. Compare:

- **Avoid quiz-like questions:** "Which promoter responds to osmotic stress?" Only experts can answer and everyone else switches off.
- **Use challenges:** "If the bacterium had to switch on only during drought, what would you measure in the soil to activate?" Anyone can reason about this kind of question and the answers lead straight to your design.

These are the challenges we used for Vinesys, a *Bacillus subtilis* designed to help grapevines cope with drought:

Challenge	What we asked the audience	What we revealed
1. The problem	"Vineyards lose 30% of their yield to summer droughts. You have every tool available to modify a bacterium. What exactly would you try to fix?"	Rather than modifying the vine, we engineer a soil bacterium that helps it: protection and less stress, giving more resilient vines.

Challenge	What we asked the audience	What we revealed
2. The function	"The bacterium does not naturally perform the function you need. What new genetic instructions would you give it?"	Two genes attacking drought on two fronts: γ-PGA, a molecule that holds water around the root, and ACC deaminase, an enzyme that lowers ethylene, the hormone a plant produces under stress.
3. The trigger	"You don't want the bacterium producing your construct constantly, because that wastes energy and weakens it. What kind of signal would you use to switch the genes on?"	Heat and high salt concentration, which accompany drought. A sigma-factor stress sensor detects them and opens the PgsiB promoter.
4. The risks	"Before releasing a designed organism into a real field, which risks would you take seriously?"	A kill-switch: the bacterium constantly makes a toxin (mazF) and only makes its antidote (mazE) in the presence of malate, a molecule found near the roots. Far from the root there is no antidote, and the toxin kills it.
5. The conversation	"You have designed the organism. Who needs to be part of the conversation before it can reach a real vineyard, and what would you ask them?"	Growers and winemakers, molecular biology experts on our bacterial chassis, soil and rhizosphere microbiologists, grapevine physiologists working on drought response, biofertiliser industry scientists and soil ecologists.

For your session, prepare one hint per challenge to avoid staying in a room that goes quiet and doesn't know what to answer. For the trigger challenge, a good hint we used for our session is "what changes in the soil when it stops raining?".

Step 3: The reveal

The reveal is where the audience learns how real design choices are made, so give it as much time as the challenge. Before revealing anything, write every idea on the board, group similar ones and ask follow-up questions such as "what could go wrong with that?" so participants have to argue their answer more. Then show your choice with the reasons behind it.

Present your answer as a choice, not as the solution. A phrasing that works: "This is what we chose. It is not the only option, and some of your ideas could work too. We went for it because…", followed by an explanation and the real limitations your idea has because of time, budget, safety and what a student lab can actually build in one summer.

When the audience matches your choice, say so because it shows them that the reasoning behind synthetic biology is within their reach. When they propose something different or better, acknowledge it openly and explain the trade-off that led you elsewhere. Never call an idea wrong even if it is not feasible. Instead, say what problem you would run into with it.

Session structure and timing

The session runs for around 70 minutes and the challenges take most of the time (be sure to create debate so people can express their opinions, which takes time). Here is a possible structure of the session, like the one we used, but adaptable to your necessities and idea:

1. **Pre-questionnaire (5 min):** Before any explanation.
2. **What synthetic biology is (10 min):** A plain definition and a few everyday examples, so the field feels familiar and not distant.
3. **The problem (5 min):** The real-world problem your project tackles, without hinting at your solution.
4. **Challenges and reveals (35 to 40 min).** About six minutes per challenge: expose it, collect the different ideas and encourage them, discuss misconceptions and great thinking and then reveal.
5. **The full design (5 min).** Put all the reveals together into one picture of the project the audience has just built.
6. **Open questions (10 min).**
7. **Post-questionnaire (5 min).** Before people stand up to leave.

Organiser tips

- **Wait before moving along the presentation:** let about ten seconds of silence pass before giving the hint or revealing the answer because people need time to think aloud.

- **Write everything down:** every answer goes on the board unfiltered. Seeing their ideas recorded is what keeps people participating and wanting to add more.
- **Ask why:** the reasoning behind an answer is more useful to the discussion than the answer itself.
- **Welcome questions mid-challenge:** answer short ones on the spot and park off-topic ones for the open questions. In general, answer any question in any moment and let the audience understand that they can stop you any moment to resolve something they don't fully get.
- **Translate specific concepts into images:** say "a switch" for a promoter, or "two keys that must turn together" for AND logic.
- **For older audiences:** use large type on slides, speak slowly and offer printed questionnaires next to the QR code.

Keep the audience active outside the challenges too. Ours voted with coloured cards on which real synthetic biology application they trusted most, debated a dilemma in pairs ("is it acceptable to release modified bacteria into a vineyard's soil?") and answered the same opening question again at the end, so they could see for themselves how their own answers had changed.

Measuring impact: pre and post questionnaires

Use the same core items before and after the talk so the two can be compared and add a few open questions at the end. To match pre and post answers keeping everything anonymous give each attendee a card with a printed code when they enter the room and ask them to copy it into both forms. This is the questionnaire we used, translated from Catalan, with one item reworded after our session (see the last section).

Pre-questionnaire only:

1. Age range
2. What is your relationship with science? (I work or study in science or health / I'm interested but it isn't my field / Little or none)
3. Had you heard of synthetic biology before? (Yes, and I know a bit / Yes, but I'm not sure what it is / Never)

Both questionnaires (true or false):

Statement	Answer
All bacteria are harmful to plants and people.	False
A bacterium's DNA can be changed so that it performs a new function.	True

Statement	Answer
A newly designed organism usually needs several rounds of testing and redesign before it works as intended. *(reworded)*	True
In the EU, releasing a genetically modified microorganism into the environment does not require prior authorisation.	False

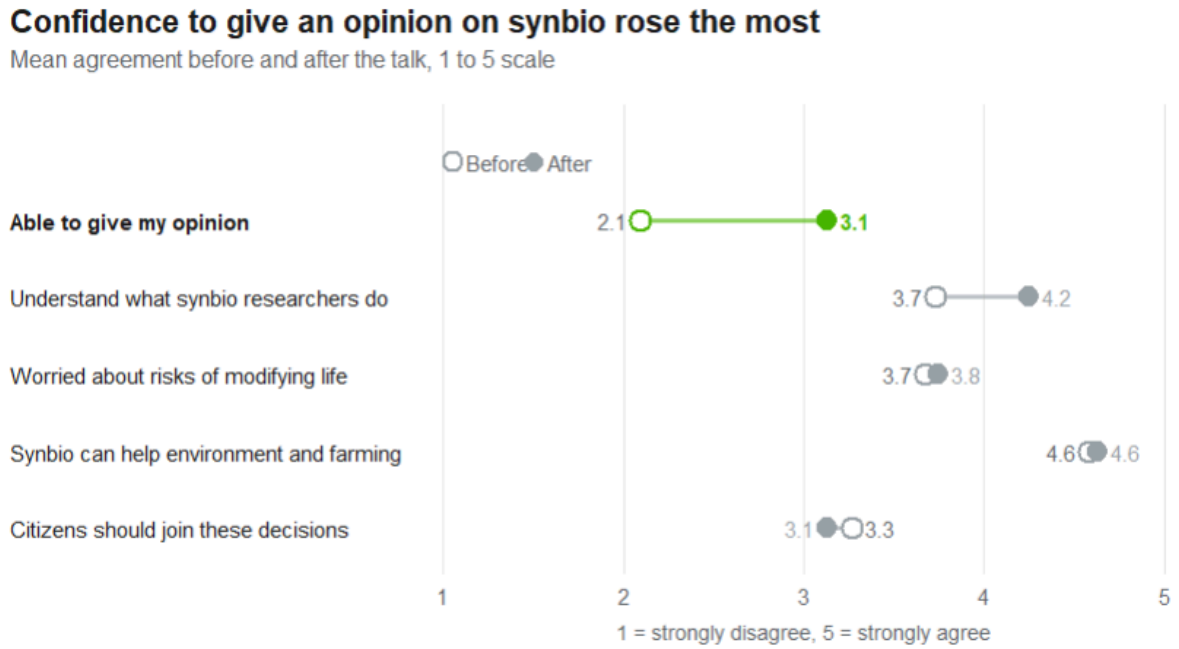
Both questionnaires (agreement from 1 = strongly disagree to 5 = strongly agree):

1. I understand what people working in synthetic biology do.
2. I feel able to give my opinion on applications of synthetic biology.
3. Citizens should take part in decisions about these technologies.
4. Synthetic biology can help tackle environmental and agricultural problems.
5. I am worried about the risks of modifying living organisms.

Post-questionnaire only

1. In your own words, what is synthetic biology?
2. After today, would you like to… (talk about it with friends or family / come to another workshop or debate / take part in a public consultation on biotechnology / learn more on your own)
3. Did you learn anything or change your mind about anything?
4. What would you improve about the activity?

What we learned running it



Pre/post questionnaires, Centre Cívic Guinardó, 14 Oct 2026: pre n = 12, post n = 8.

What we would change next time:

- **Avoid double negatives.** Our original testing item read "there is no need to test or redesign it again". Correct answers fell from 70% to 50% even though the talk covered the DBTL cycle, most likely because the phrasing confused people (in Catalan it even sounded more confusing than in English). We have included a reworded version in this kit. We strongly advise using shorter and simpler sentences to avoid people selecting the incorrect answer because of the language and not their understanding.
- **Pick true or false items people are likely to get wrong.** Our other three items were already above 80% correct before the talk, so they could not show any gain. If you choose question that are related to the most common misconceptions the results will go up and the participants will actually apply what they learned to a false statement they previously had (double learning, both during the talk and by themselves when answering the questionnaire, so it is more likely the information sticks with them).
- **Plan for more time.** Attendees asked for a longer session and more practical applications, which is why we recommend 70 to 90 minutes. However, this preference can be changed for different audiences and we also encourage adapting on the spot depending on the enthusiasm and interest of the participants.
- **Treat the numbers as indicative.** With 12 pre and 8 post answers, the comparison shows a direction, not a statistically robust effect.