

GM release

A brief guideline for iGEM teams

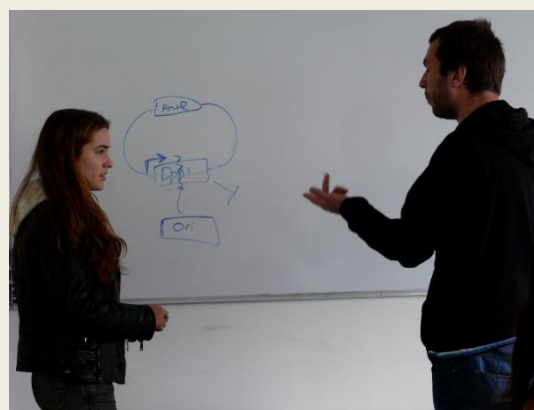
There are many different aspects that need to be considered for the release of GM bacteria into the environment. iGEM projects carry a lot of potential in areas such as bioremediation, but environmental release is often necessary. However, such release is neither legal nor ethical unless the safety of the organism can be proven.



Preliminary questions

There are some things you might want to consider before looking into the options for releasing your GMO:

- Does the organism have to be released?
- Is there a way to contain your GMO in the lab?
- If you can't contain them in labs, can you contain them in portable devices?
- Can you work with cell-free systems?



Once you have decided that environmental release of live organisms is the only way of allowing your project reach its full potential, there are a whole range of questions to consider.

Assessing environmental impact

Ecological systems are very complex and easily disturbed. Try and analyse the ecosystem your organism is going to be released into. A good way to look into environmental aspects is to do a literature review. However, it can also be very useful to talk to experts in the field who may be able to point out some important research or experiments you could perform yourself. Some questions you might want to consider are:



- How do the proteins that your organism produces affect key beneficial organisms such as earthworms, bees, beetles etc.?
- How do they affect others, such as fish, protozoa, small vertebrates, plants, etc?

Assessing safety and spread

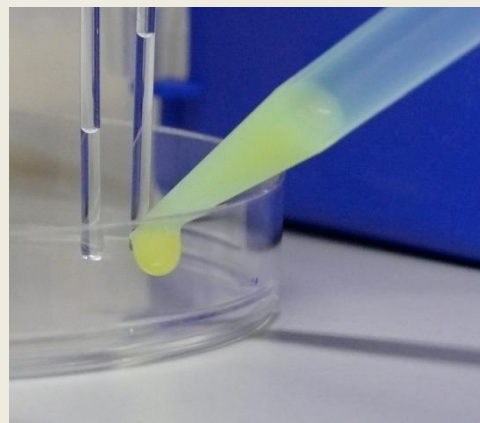
There are two main things you have to consider.

The first is the possibility of unintended consequences:

- How can you retrieve the organism once it has been released? Most countries have strict policies that prohibit the release of any organism that cannot be extracted from the environment if it has a negative impact.
- Could it spread to other environments and damage them?
- How can you prevent horizontal gene transfer? Suicide mechanisms are a very useful invention but they are never 100% effective. In addition, DNA released by dead bacteria can still be taken up by other, live organisms. Try and analyse the spread of the genetic information itself rather than the chassis you are using.

You also have to consider the possibility of intentional misuse:

- Could a person, corporation or country abuse this project for bioterrorism or biowarfare?
- Would they be able to use individual BioBricks for malign intents?



Legal issues

You should look at the laws of the countries where you are planning to implement your project. GM laws are very strict in some places such as the EU but much more permissive in others such as the US. You will likely not have enough time to look at every law in detail but you might be able to contact lawyers and look at summaries of **the laws that apply in your chosen country or countries of implementation.**

In addition, should you want to export the organism from where it is engineered, you have to consider international laws and statutes. Two important ones to look at are the **Rio Declaration on Environment and Development** and the **Cartagena Protocol.**

Implementation

You might also want to think about how your project can be sensibly implemented. There might be cultural or religious factors that could influence how your project can be used efficiently without causing offence. You may consider talking to people who are trying to tackle similar problems and seek advice on successful strategies.



Most of these questions can probably not be answered in the time you have for your project. You might therefore want to think about how you would be able to drive the development of your project after the iGEM competition.

- Could the project be taken up by a company?
- Could it be carried on at your university with appropriate funding?
- Could you get charities involved?

Many agricultural and pharmaceutical products, among others, take decades to be developed because they have to go through extremely rigorous safety testing. So bear in mind that your project would likely need to go through the same process!

Good Luck!