

Science museum workshop



A double plasmid system
for enhanced biosafety

What is iGEM?

Each year, high schools and universities from all over the world form a team of driven students to compete in the iGEM competition, where the goal is to tackle a problem using **synthetic biology**. Last year, the Leiden iGEM team achieved massive success by winning the Grand Prize with their project Rapidemic; now it is the turn of the fresh **Leiden iGEM team 2021** to try and defend this coveted title. This time, we take on the challenge of biocontainment, with our new project named **DOPL LOCK**.

Our Project

Over the course of the iGEM competition, many wonderful projects have been developed, tackling some of the world's most challenging issues, such as plastic pollution, the bleaching of coral reefs, or insect plagues. However, the solution to many of these problems require the release

of **genetically modified organisms (GMOs)** into the environment. When these bacteria start spreading, their synthetic genes have the potential of outcompeting the natural ones, which would result in the decline of biodiversity and could ultimately lead to catastrophic environmental damage.

To solve this problem, we have designed a system that utilizes two methods to diminish the spread of modified genes. At the basis of this system lies the use of **two interdependent plasmids**, preventing the transfer of them between unrelated bacteria. On top of that, a '**conditional promoter**' on the plasmids cause the cell to die when it leaves specific conditions. Combining these techniques, the proliferation of bacteria will be severely restricted by this double plasmid lock, or DOPL LOCK as we like to call it. With this project, we want to provide other iGEM teams with a **solid basis** to build their system upon, hopefully realizing some of the amazing solutions in the future.

The stand at the museum will be divided into two parts: a workshop and an information stand. Both will be accessible simultaneously. Visitors are able to join any time during the workshop.

Information booth

The first part of the stand contains information about iGEM, and the adventure of iGEM Leiden with our project DOPL Lock. Through the deliverables that we have created for the competition, we can share our experience in this competition. We will also bring three laptops where we will show pictures of our experience, and also our presentation video and our promotional video. Another computer will be used to show our website (wiki), which encompasses all the aspects of our project. The aim is not for the visitors to watch everything. Instead, the team will be there to address the visitors and engage in conversation, to share about iGEM and our project. The materials are merely a representation of our efforts and a good, colorful way to appeal to the visitors.

This will be a good place to engage in a discussion with visitors about GMOs, biosafety and synthetic biology.

Target audience: This part of the stand will be suitable for an audience of teenagers, adults and elderly.

Workshop

Visitors are able to walk in and out anytime during the workshop

Target audience: This will be most enjoyed by children and their parents.

Introduction & Presentation (3minutes)

The presentation (and whole workshop) will be held in Dutch to increase audience participation. Visitors can take a seat while iGEM shows off different experiments, taking volunteers from the audience. Two presentations will be given, one at 10:30, the other at 13:00.

Matching microbes (10 minutes)

4 Petri dishes with colonies of bacteria and fungi (*Escherichia coli*, *Bacillus subtilis*, *Streptomyces coelicolor* and *Aspergillus niger*) covered with epoxy would be laid out for visitors to see. Next to this, there are pictures showing the microscopic representation of the microorganism. It is up to the player to match the microscopic view of the microorganisms to the corresponding petri dish. Multiple copies of this exercise will be printed and handed out to the audience.

GMO what? (10 minutes)

We will explain what a GMO is and back this up with an example; our own GFP (Green Fluorescent Protein) mutant *E. coli* cells. We will take agar plates coated with epoxy for

visitors to inspect. After inspecting, we hand out yellow glasses to the audience and shine blue light on the plates, this will make them glow green (the yellow glasses make it so you see the cells glow even more vibrant). This will be fun for the younger audience as they look like disco plates.

The scientist game – finding your own DNA! (20 minutes)

This is a game to give children the real experience of being in the lab. We will bring goggles, a labcoat and a micropipette for the children to dress up in and play with.

The game consists of two parts: pipetting and seeing your own DNA.

The aim of the first game is to transfer different volumes of colored water (lemonade) from one Falcon tube to another using the pipette. The children/teenagers will have to adjust the volume of the pipette accordingly. This activity will be aimed at children between 8-16.

Then we will isolate DNA from saliva. Children will follow a protocol:

- Dissolve half a tablespoon of salt in 200ml water in a beaker
- Transfer a tablespoon of the salt solution into a glass
- Wash your mouth for two minutes with the salt solution
- Spit the solution back into a beaker
- Put a few drops of washing soap into the beaker and stir
- Pipette 9ml of 97% alcohol into the beaker
- Wait for 2 minutes
- DNA will jump out of solution and be visible as white strings
- Pick it up with a stick and study it

What grows on my hands? (10 minutes)

Another mini activity is to determine the efficacy of hand washing against the presence of bacteria (pathogenic or not). Here, we will provide agar plates for culturing bacteria. The children or adults are invited to wash their hands (with soap or gel), or not, and to place their hand on the agar. The audience can take the plates home and within a few days, colonies start to appear. This activity aims to show the diversity, and abundance of the bacteria living on our hands. It also demonstrated the (in)efficacy of washing our hands with soap vs alcohol gel.

Closing (10 minutes)

Discuss:

What did you learn?

What did you think was most fun?

What will you remember of today?