

# From EPFL to MIT

iGEM: a challenging competition for an all-female EPFL engineering team

## MIT

Massachusetts Institute of Technology has no less than 78 Nobel prize winners. MIT holds the world's biggest synthetic biology competition: iGEM

## EPFL

Ecole Polytechnique Fédérale de Lausanne selected ten of their best students for the sixth year in a row to compete in iGEM.

## 10 young women

For the first time in six years EPFL's team is exceptionally composed of 10 female students.

## iGEM or the world's biggest synthetic biology competition

*"iGEM is a great opportunity for students to get involved in an international project and work closely as a team with other fellow students. It gives us a glimpse of what our professional careers could look like, especially in the industry sector where working in teams and meeting deadlines is essential to the success of the project. From concept to implementation, we get to see all the steps of a Life Sciences project, all in the space of a few months."*

-2012 EPFL iGEM team-



Massachusetts Institute of Technology

## iGEM: the international Genetically Engineered Machine competition

iGEM was launched at MIT with the goal of bringing students from different backgrounds together in order to compete and share knowledge about synthetic biology. The teams will present their respective projects to a panel of judges in November in Boston at MIT.

The accomplishments of these student teams during one summer are often impressive and will lead to important advances in medicine, energy, and the environment.



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*“For the first time in six years, EPFL’s team is exceptionally composed of 10 female students. This clearly reflects the current tendency of women to be more and more involved in engineering, which is an exciting and in our opinion essential development.”*

## Introduction to iGEM

The International Genetically Engineered Machine (iGEM) competition is a worldwide synthetic biology competition initially aimed at undergraduate university students, but has since expanded to include divisions for high school students and entrepreneurs. The world’s best universities are represented in the competition by a team of their best students. Student teams are given a kit of biological parts at the beginning of the summer from the Registry of Standard Biological Parts (community collection of biological components). Working at their own schools over the summer, they use these parts and new parts of their own design to build biological systems and operate them in living cells. The student’s teams will specify, design, build, and test simple biological systems made from standard, interchangeable biological parts.

In the fall, teams will come together to present their summer projects and to compete for awards and prizes. Teams will first compete in Regional Jamborees in their region (Europe, Asia, Latin America, Americas-East, Americas-West). A percentage of teams advance to the World Championship Jamboree held in Boston, MA, USA, on the MIT campus.

This year, Ecole Polytechnique Fédérale de Lausanne (EPFL)’s team is exceptionally composed of 10 young women. The team is very motivated and excited to first present their project in October in Lyon (France) for the European jamboree and hopefully to the World Championship jamboree in November, which takes place at MIT in Boston. It will be an honor for the team to represent EPFL and Switzerland at this amazing event gathering 213 teams of synthetic biology fans from all over the world.

## A Synthetic biology example

Biosensors, which permanently reside in the body to detect a particular type of abnormality, for example arterial disease. The biosensor will be part of a machine engineered by means of synthetic biology, which then manufactures or releases a 'drug' to disperse the arterial plaque.

## Synthetic biology

Synthetic biology is the design and construction of biological devices and systems for useful purposes. It is an area of biological research and technology that combines biology and engineering, thus often overlapping with bioengineering and biomedical engineering. It encompasses a variety of different approaches, methodologies, and disciplines with a focus on engineering biology and biotechnology

Synthetic biologists approach the creation of new biological systems from different perspectives, focusing on finding how life works (the origin of life) or how to use it to benefit society. The former focus includes the approach of biology, inserting man-made DNA into a living cell; and chemistry, working on gene synthesis as an extension of synthetic chemistry.

The latter focus includes engineering,

building new biological systems as a platform for various technologies; and rewriting, rebuilding the natural systems to provide the engineered surrogates.

## The School of Life Sciences at the EPFL

The School of Life Sciences lies at the crossroads between biology, medicine, basic sciences, informatics and engineering. Created in 2002, the School of Life Sciences is the youngest faculty at EPFL. Capitalizing on our initial development in neurosciences and bioengineering, we rapidly extended our scope to cover cancer, metabolic diseases and infection biology. It was created with the strong belief that biologists and medical doctors need to collaborate with specialists in chemistry, physics, mathematics, and computer science to take biomedical research to new frontiers.

*“For us professors, iGEM is a great experience. We are lucky to work with such motivated and brilliant students, and are able to work with them, from the conception of the project to its realization and presentation at MIT. In addition, students lead us to as yet unexplored areas...”*

*-Bart Deplancke and Sebastian Maerkl, EPFL professors*





## iGEM Goals

To enable the systematic **engineering of biology**.

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To promote the open and transparent **development of tools** for engineering biology.

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To help **construct a society** that can productively and safely apply biological technology.

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This project design and competition format is an exceptionally **motivating and effective teaching method**.

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The organization promotes the **advancement of science and education** by developing an **open community** of students and practitioners in schools, laboratories research institutes, and industry.

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It also fosters scientific research and education by establishing and operating the **Registry of Standard Biological Parts**, a community collection of biological components.

## The EPFL team and their project

10 undergraduate students from EPFL have been selected to take part in the 2013 EPFL team. The students start working on the project in early February, with introductory courses and many brainstorming meetings, involving the implementation and development of the project.

The students benefit from the experience in various ways:

- They learn to **develop a project/idea** and carry it out to completion in a concrete manner
- They develop **team spirit** whilst working in a multidisciplinary group
- Their **creativity and critical thinking** are highly encouraged

They **meet and compete** with the world's best engineering students.



# iGEM 2013 EPFL Team: 10 promising young women

## Nadia Bérard

**Birth:** 07.07.1988 in Bern

**Nationality:** Swiss

**Language:** Italian and French (mother tongues), English and German

**Study:** Bachelor Semester 6 in Life Science at EPFL

**Job:** Warden at Centre d'accueil MalleyPrairie (emergency center for women victims of violence). Auxiliary for a disabled person.

**Hobby:** Sports and music

**Passion:** Travelling around the world



## Charlotte Broennimann

**Birth:** 24.12.1988 in Morges

**Nationality:** Swiss and Spanish

**Language:** French, Spanish and Valenciano, as mother tongues. English, German.

**Study:** Bachelor Semester 6 in Life Science at EPFL.

**Job:** teacher in Ecole Nouvelle de la Suisse Romande's summercamp and wintercamp (sports, ski, English, German and French)

**Hobby:** all kind of sports, ski and horse riding.



## Sandra Elisabeth Chaudron

**Birth:** 28.07.1990 in Abidjan (Côte d'Ivoire)

**Nationality:** French

**Language:** French (mother tongue); English; German.

**Study:** Bachelor Semester 6 in Life Science and Master Semester 2 in Molecular Medicine at EPFL.

**Job:** Help a PhD student on her project in the Laboratory of Virology and Genetics at EPFL.

Give private lessons to teenagers in Sciences, German, English, and French.

**Hobby:** Sport, Manual arts, Logic Puzzles, Music, Video Games.

**Passion:** Animals, Travels and Infectious Diseases



## Léa Bernier

**Birth:** 27.01.1993 in Neuchâtel

**Nationalities:** Swiss, Canadian and French

**Language:** French (mother tongue), English, German, Mandarin (beginner)

**Study:** Bachelor Semester 4 in Life Sciences at EPFL

**Hobby:** Music, traveling



## Mareike Apelt

**Birth:** 29.08.1989 in Baden

**Nationality:** Swiss and German

**Language:** German (mother tongue), Swiss German, French English and basics in Swedish

**Study:** Bachelor Semester 4 in Life Sciences at EPFL

**Job:** worked 3 years in a winery

**Hobby:** Swimming, reading



## Sophie Rivara

**Birth:** 05.11.1992 in Geneva

**Nationality:** Swiss

**Language:** French (mother tongue), English and German

**Study:** Bachelor Semester 4 in Life Sciences at EPFL

**Hobby:** Music and sport



## Luisa Spisak

**Birth:** 26.10.1990

**Nationality:** Swiss

**Language:** German, Swiss German, French, English, Slovak

**Study:** Bachelor, 3<sup>rd</sup> semester in Life sciences

**Hobby:** Reading books by Stephen King, watching TV, Sports

**Passion:** Science





## Caroline Rose Desmurget

**Birth:** 25/12/1991

**Nationality:** French

**Language:** French (mother tongue), English, Spanish

**Study:** Bachelor semester 4, life Science, EPFL

**Hobby:** reading (when I have time!)

**Passion:** Cooking



## Axelle Justafré

**Birth:** 19/05/1991

**Nationality:** French and Swiss

**Language:** French (mother tongue), English

**Study:** Bachelor semester 4, life Science, EPFL

**Hobby:** drawing

**Passion:** Cancer research



## Marcelle Isaline Arrigo

**Birth:** 10.09.1992

**Nationality:** Swiss

**Language:** English mother tongue, French, Italian, German

**Study:** Bachelor Semester 6 in Life Science

**Job:** works as a semi-pro model and gives courses to children

**Hobby:** music

**Passion:** travelling



## Team coaching

Two EPFL professors will take care of coaching the team and will open their laboratories to students for the development of the project:



### **Prof. Bart Deplancke**

Assistant Professor  
*Laboratory of Systems Biology And Genetics*  
Institute of Bioengineering, School of Life Sciences

« Margin of Excellence Research Proposal Award »  
« Peter Reeds Young Investigator Award »

[bart.deplancke@epfl.ch](mailto:bart.deplancke@epfl.ch)



### **Prof. Sebastian Maerkl**

Assistant Professor  
*Laboratory of Biological Network Characterization*  
Institute of Bioengineering, School of Engineering

« 2012 Prix SSV - Ambition: EPFL prize for dedication to teaching and promotion of EPFL students and the school at large. »

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### **Dr. Sacha Sidjanski**

*External relations/Partnership - School of Life Sciences*

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## Your support, your participation

The EPFL will participate in financing the project. The costs of the European jamboree in Lyon and the costs related to instruction and supervision, as well as the traveling costs for the professors are fully covered by the School of Life Sciences. However, the EPFL cannot cover all costs. In order to offer the best conditions to our students and be competitive, we are looking for financial partners/sponsors to contribute to our participation in the World Championship jamboree taking place in Boston, MA. In return, we guarantee maximum visibility in Switzerland as well as internationally. Some examples of press coverage concerning the participation of the EPFL at MIT in the last few years (articles available on demand):

- Le Temps
- 24 Heures
- Le Nouvelliste and Flash (EPFL newspaper)



**iGEM in a few numbers:**

**Over 3500** participants from the best universities.

**213 teams** worldwide taking part in the competition.

**34 countries** represented.

## iGEM EPFL team budget 2013

iGEM EPFL team budget	Initial costs	European jamboree LYON (FRANCE)	World Championship BOSTON, MA (USA)
iGEM biological and chemical materials, tools & equipment. Realization of the project.	20'000 CHF	0	0
Transportation (10 students)		1'300 CHF	11'000 CHF
Accommodation (10 students)		3'000 CHF	8'000 CHF
iGEM application fees		1'800 CHF	1'800 CHF
Promotional articles		500 CHF	500 CHF
<b>TOTAL</b>	<b>20'000 CHF</b>	<b>6'600 CHF</b>	<b>21'300 CHF</b>

\* The costs of instruction and supervision, as well as the travelling costs for the professors, are omitted from the table above as they are fully covered by the School of Life Sciences.

# Project summary

## The Taxi.Coli project

The global aim of this project is to engineer *E. coli* (*Escherichia coli*) to transport a cargo and release it at a given signal. Our bacteria will have nanoparticles, able to contain any organic substance, attached to them. They will act as sensors, triggering the release of their cargo when the signal appears. The opening of the nanoparticles will be triggered by an enzymatic secretion dependent on an inducible promoter reacting to the desired signal.

We can imagine many applications for these Taxi.Colis. What we will implement during this summer are *E. coli*s carrying drug-filled nanoparticles. We will make them sensible to signals such as low pH, surface proteins of parasitic worms or toxins secreted by pathogenic bacteria. When the inducible opening of the capsules is implemented, the functional Taxi.Colis could theoretically be introduced in the colon or in the gut, where they could act as sentinels, releasing their drug once they have localized their target. We also see our

project as a proof of principle, that could be brought further. Indeed, if the system appears to be as efficient as expected, one could implement it with other cells, such as immune cells (that could directly localize the right target). The applications of the Taxi.Coli project are very broad. For now, our bacteria will be like taxis, randomly driving across town, waiting for a client. And as soon as the client makes a sign, the taxi driver recognizes it and opens the door...



For complementary information, please see the websites below:

EPFL: [www.epfl.ch](http://www.epfl.ch)

MIT: [web.mit.edu](http://web.mit.edu)

iGEM: [2013.igem.org](http://2013.igem.org)

iGEM-EPFL 2011 Project: [http://2011.igem.org/Team:EPF\\_Lausanne/Home](http://2011.igem.org/Team:EPF_Lausanne/Home)

Thank you for your interest and support. Sincerely, the team.



Massachusetts  
Institute of  
Technology

