FIGHT TUBERCULOSIS WITH MODERN WEAPONS
Tuberculosis is a worldwide disease.

1 in 3 of the world population has latent tuberculosis.

1.3 million deaths per year.
FIGHT TUBERCULOSIS with MODERN WEAPONS

detect

infiltrate

target

infiltrate

sabotage

gender study
**INFILTRATE**

It mostly affects the lungs...

Tuberculosis can be **active** or **latent**.

★ Latent TB forms granulomas in the lungs where it can survive even inside macrophages.

Gender study

Detect and target infiltration.
LLO : Listeriolysin O
TDMH : Trehalose Dimycolate Hydrolase
Infiltrating macrophages with an E.coli producing TDMH - an E.coli that lyses mycobacterial cell walls
TDMH-expressing E. coli kill mycobacteria in culture

- **Mycobacteria alone**
- **Mycobacteria + E. coli (Uninduced)**
- **Mycobacteria + E. coli (TDMH-induced)**

**Y-Axis:** Mycobacterial Survivors

**X-Axis:** Time (Hours)
TO DIAGNOSE MULTI DRUG RESISTANCE CAN TAKE FROM 21 DAYS TO 3 MONTHS
A biosensor that detects the presence of specific antibiotic resistance genes.
Cotransformation of E. coli with Cas9 and gRNA vectors in Kanamycin Sensitive and Resistant Strains
Parallel assembly of genes of interest

BioBrick
Backbone

Multiple inserts

Complete BioBrick Plasmid
**SENSIGEM: A BIOSENSOR DATABASE**

[www.sensigem.org](http://www.sensigem.org)

**Collaboration**

**OpenData**

**Tools**

---

**Filter projects** 229 projects

<table>
<thead>
<tr>
<th>Team</th>
<th>Year</th>
<th>Title</th>
<th>Biosensor</th>
<th>Category</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHUT China</td>
<td>2013</td>
<td>The Shinning Sanctifier</td>
<td>Yes</td>
<td>Environment</td>
<td>Our goal is to design a wastewater treatment system which can absorb the pol...</td>
</tr>
<tr>
<td>Baskent Meds</td>
<td>2013</td>
<td>Transformation of <em>Escherichia coli</em> In Order To Develop <em>Legionella pneumophila</em> Sensing Bacteria</td>
<td>Yes</td>
<td>Health and Medicine</td>
<td>Legionella pneumophila is the cause of the Legionnaires' disease which is a ...</td>
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<tr>
<td>BIOSINT Mexico</td>
<td>2013</td>
<td>Smartpro</td>
<td>Yes</td>
<td>Health and Medicine</td>
<td>This year Biosint Mexico team will be developed a smart probiotic. Along ...</td>
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<tr>
<td>BIT</td>
<td>2013</td>
<td>Cr(VI)-biosensor to detect chromate in dairy products</td>
<td>Yes</td>
<td>Environment</td>
<td>As we know, antibiotics are widely used in modern industry to prevent the in...</td>
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<tr>
<td>Buenos Aires</td>
<td>2013</td>
<td>No Title</td>
<td>Yes</td>
<td>Environment</td>
<td>Our project is focused on developing a biosensor specific for certain water ...</td>
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</tbody>
</table>
Underrepresentation of nucleic acid biosensors

Nucleic Acid Biosensors (6)

Other Biosensors (221)
35% of adults infected with TB are women.
BIOLOGICAL vs SOCIAL

Our Team

Our Advisors & Instructors
DATA DRIVEN APPROACH

50 Synthetic Biology Laboratories
ALL SB Conferences
731 Teams screened

1 Database
All info available on wiki
**WOMEN ARE UNDER REPRESENTED in SYNTHETIC BIOLOGY AND iGEM**

Gender Balance of Synthetic Biology Labs

- Labs
- PhD students
- Post Doc
- Head of Labs

The iGEM gender gap has not changed significantly since 2007

Percent of iGEMers

- Men
- Women

Year

- 2007
- 2009
- 2011
What did you hope to learn in iGEM

**Women do not supervise as much as Men**

**Sex ratio in iGEM according to role**

<table>
<thead>
<tr>
<th>Role</th>
<th>Percent Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>40%</td>
</tr>
<tr>
<td>Supervisors</td>
<td>20%</td>
</tr>
<tr>
<td>Judges</td>
<td>0%</td>
</tr>
</tbody>
</table>

**What did you hope to learn in iGEM**

- Working on a team
- Designing a project
- General lab experience
- Human practices
- Programming and Modeling
- Leading a team
- Leading a project

Interest level (5 = high)
Women are better represented in winning iGEM teams

Prize - winners: 40%
All teams: 30%

p = 0.035
RECOMMENDATIONS

★ Raise the number of women judges
★ Motivate young women to be advisors
★ Encourage gender reflection in SynBio

iGEM a leader and an example of an active gender policy that can be measured
SABOTAGE

detect

target

infiltrate

1 MDR PATIENT ARE SUCCESSFULLY TREATED

3

gender study

sabotage
A phage system with low fitness cost producing sRNA which inhibit the synthesis of antibiotic resistance proteins.
Killing Chloramphenicol resistant E.Coli population with Chloramphenicol

<table>
<thead>
<tr>
<th>Concentration of Chloramphenicol (ug/mL)</th>
<th>% of surviving cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non infected</td>
<td>100</td>
</tr>
<tr>
<td>Infected</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>500</td>
<td>10</td>
</tr>
<tr>
<td>1000</td>
<td>10</td>
</tr>
</tbody>
</table>

Origin of resistance of the sequential killing

- Non infected
- Non silenced
Adaptable silencing tool

24 bp Target-binding sequence

- Pr promoter
- Anti-Cm
- Scaffold Originated from MicC
- T1/TE

BioBricked x3
TARGET

- detect
- infiltrate
- target
- sabotage

ONE NEW DRUG APPROVED IN THE LAST 40 YEARS

gender study

one new drug approved in the last 40 years
A safe and specific high throughput drug screening method that targets essential mycobacteria metabolic proteins.

FIND NEW DRUG!
Growth curves of E. coli mycoSIR

A

Growth (OD)

Time (hours)

0 3 6 9 12

B

WT BL21
BL21 Δ cys
MycoSIR E.coli
MycoSIR uninduced
Technology Transfer

Science and technology always have a human face!

Focus on the concrete effects and local circumstances

Talk to patients, doctors and policy makers

Nicola Bertoldi
Scientific Accomplishments

- detect
- infiltrate
- target
- sabotage
SCIENTIFIC ACCOMPLISHMENTS

- 4 new biobricks
- New assembly standard
- Detection of kanamycin resistance gene

- Detect
- Target
- Infiltrate
- Sabotage
4 new biobricks
New assembly standard
Detection of kanamycin resistance gene

1 new biobrick
E. coli that kills M. smegmatis

SCIENTIFIC ACCOMPLISHMENTS

detect

infiltrate

sabotage
SCIENTIFIC ACCOMPLISHMENTS

- 4 new biobricks
- New assembly standard
- Detection of kanamycin resistance gene

- 1 new biobrick
- E. coli that kills M. smegmatis

- 3 new biobricks
- Successful silenced antibiotic resistance cassettes
- Modelling

- Target
- Infiltrate
- Detect
4 new biobricks
New assembly standard
Detection of kanamycin resistance gene

3 new biobricks
Functional metabolic pathway of M. smegmatis in E. coli
Modelling

1 new biobrick
E. coli that kills M. smegmatis

3 new biobricks
Successful silenced antibiotic resistance cassettes
Modelling

Scientific Accomplishments

detect

target

infiltrate

sabotage
Our Team

N Koutsoubelis  A Bernheim  S Jaramillo R.  M Benony  Y Zegman  S Zahra

A Löchner  C Basier  C Bencherif  V Libis  I Aghoghoge  M Deyell  E Atanasković

Our Advisors & Instructors

A Lindner  J Wintermute  Z Marinkovic  M Toulouze