LACTONUTRITIOUS

it's delicious
The problem

• Malnutrition – micronutrients

• Cause of 2.8 million blind children

• 371 million USD
Vision

How can synthetic biology solve this problem?

- One single food item.
- Eliminate purification and extraction.
- Ability to grow anywhere in the world.

Jalapeno  Soy sauce  Yoghurt
Nothing!
A Lactonutritious new world

When the nutrients are not enough, go plus.

- Yoghurt+
  - Made from fermented milk.

- Jalapeño+
  - Made from jalapenos.

- Nutritious+
  - Made on agricultural rest products.

- Garri+
  - Made from Cassava roots.

- Soy Sauce+
  - Made from soybeans.
What are probiotic bacteria?

• Mutualism
• Health benefits:
  – Strengthen the immune system
  – Provide help for the intestinal flora
LACTONUTRITIOUS
A *Lactobacillus chassi*

- Positive effects of *Lactobacillus*:
  - Conservation method
  - Food grade
  - Relieving effects
  - Pre-existing in intestinal flora
Now all iGEM teams can work with probiotic bacteria.

Shuttle vector. Works in both *E. coli* and *Lactobacillus*.
What do we want to do with this new probiotic platform?

What should I do with all these wonderful tools?
Choice of pathway

Phenylpropanoid pathway

Carotenoid pathway
Zeaxanthin

p-Coumaric acid

Resveratrol

Crocin

Picrocrocin

Safranal
Questions

What amount of nutrients do we want our bacteria to produce?
- Promoter strength?
- High or low copy plasmid?
Mathematical modeling of phenylpropanoid pathway

Choice of promoter and copy number of plasmid.
Low/medium strength promoters and plasmids

Modeling of p-Coumaric acid concentration over time

- Yellow line: Tyrosine outside cell
- Orange line: Tyrosine inside cell
- Green line: Total p-coumaric acid

X: 48
Y: 169.9
p-Coumaric acid

Tyrosine \[\xrightarrow{TAL}\] p-Coumaric acid
Expression of TAL in *E. coli*

1. Positive control
2. Tyrosine Ammonia Lyase
3. Tyrosine Ammonia Lyase
4. Negative control
Our bacteria produces p-Coumaric acid

Absorbance spectra from bacterial cultures
HPLC showing production of p-Coumaric acid

Tyrosine Ammonia Lyase expressed in *E. coli*

Standard (50 µM p-Coumaric acid)

Negative control
Yoghurt+
What will the public think about me?

- What happens if our genetically engineered bacteria spread in nature?
- Is there a risk to our health by drinking this yoghurt?
Safety test

Competition test. *E. Coli Nissle* with TAL against Wildtype.
Do you know what GMO stands for?

- YES: 16%
- NO: 84%

What is your opinion concerning GMO?

- For GMO: 36%
- Against GMO: 30%
- Not sure: 34%
Would you consider drinking our yoghurt?
Summary of achievements

✔ Developed fundamental tools for *Lactobacillus* such as:
  ✔ - Promoters
  ✔ - Reporter genes
  ✔ - Shuttle vectors

✔ Successfully produced & characterized several healthy molecules in *E. coli*

✔ 63 new BioBricks were sent to the iGEM registry

✔ Provided several chromoproteins to iGEM teams and other external research groups

🏆 Best natural BioBrick, Europe. Tyrosine ammonia lyase.
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