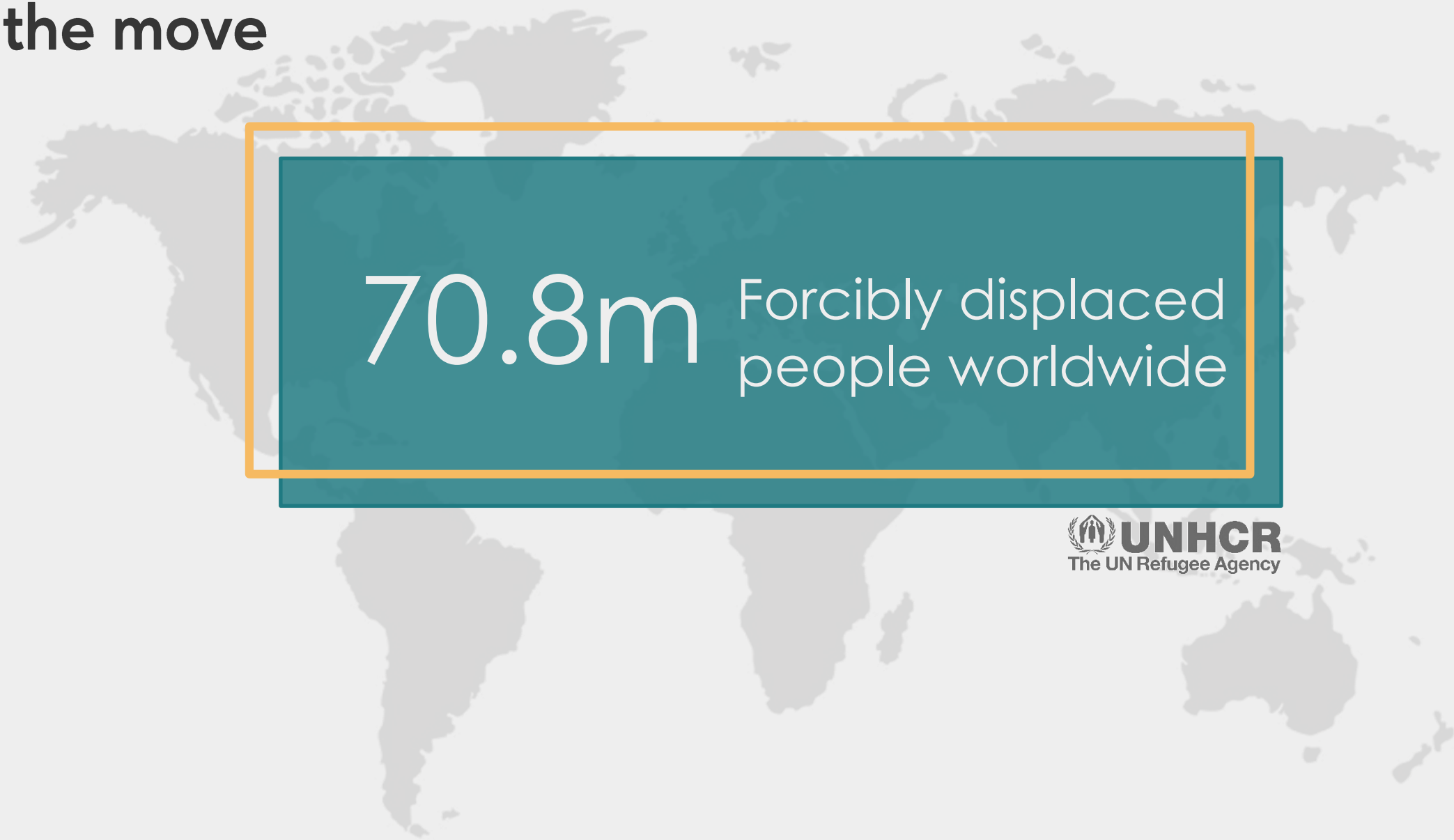

I GEM Thessaly

Our Inspiration.

People on the move



Our inspiration.

People on the move

People on the move

Greece's population

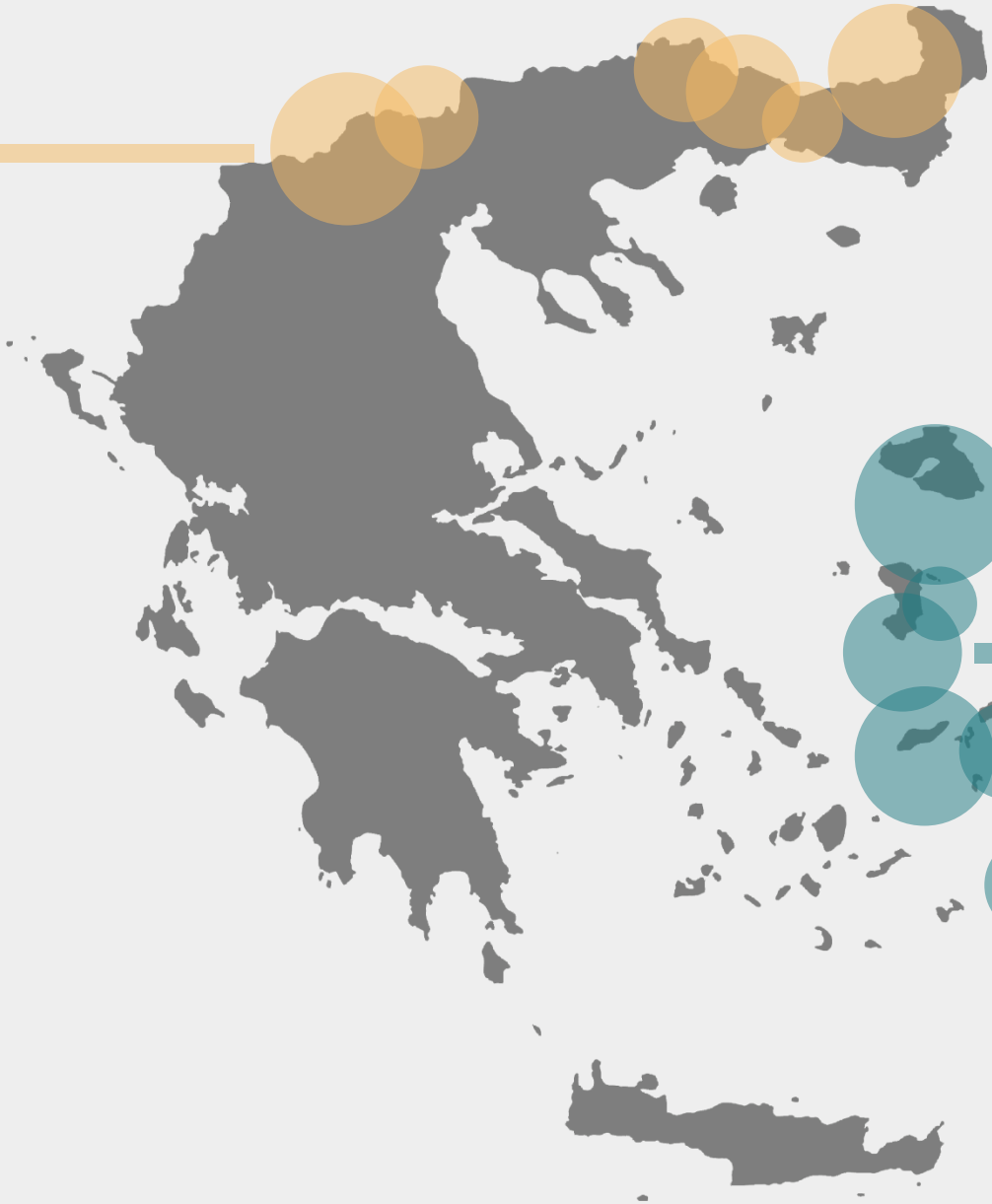
10.8 m

1.1 m

Cumulative Total of refugees (2015-19)

By Land

By Sea



Our inspiration.

People on the move

By Land

By Sea

Limited access to healthcare

Our inspiration.

A lethal disease

Tuberculosis (TB)

1 of *10*
causes of death worldwide

Mycobacterium tuberculosis

Active
or
Latent

Our inspiration.

A sneaky killer

36%

of people infected with **TB were left undiagnosed** in 2017

WHO, TB Global Report (2018)

Our inspiration.

We present you a new era of TB diagnostics

DYSSEE

Simple. Safe. Universal.

The type that is important to be detected for screening purposes is active TB.

Dr. Simona Karampela

ΓΕΝΙΚΟ ΝΟΣΟΚΟΜΕΙΟ
ΝΟΣΗΜΑΤΩΝ ΘΩΡΑΚΟΣ ΑΘΗΝΩΝ
Η ΣΩΤΗΡΙΑ

Project Design.

Our Considerations

Biological sample

Urine

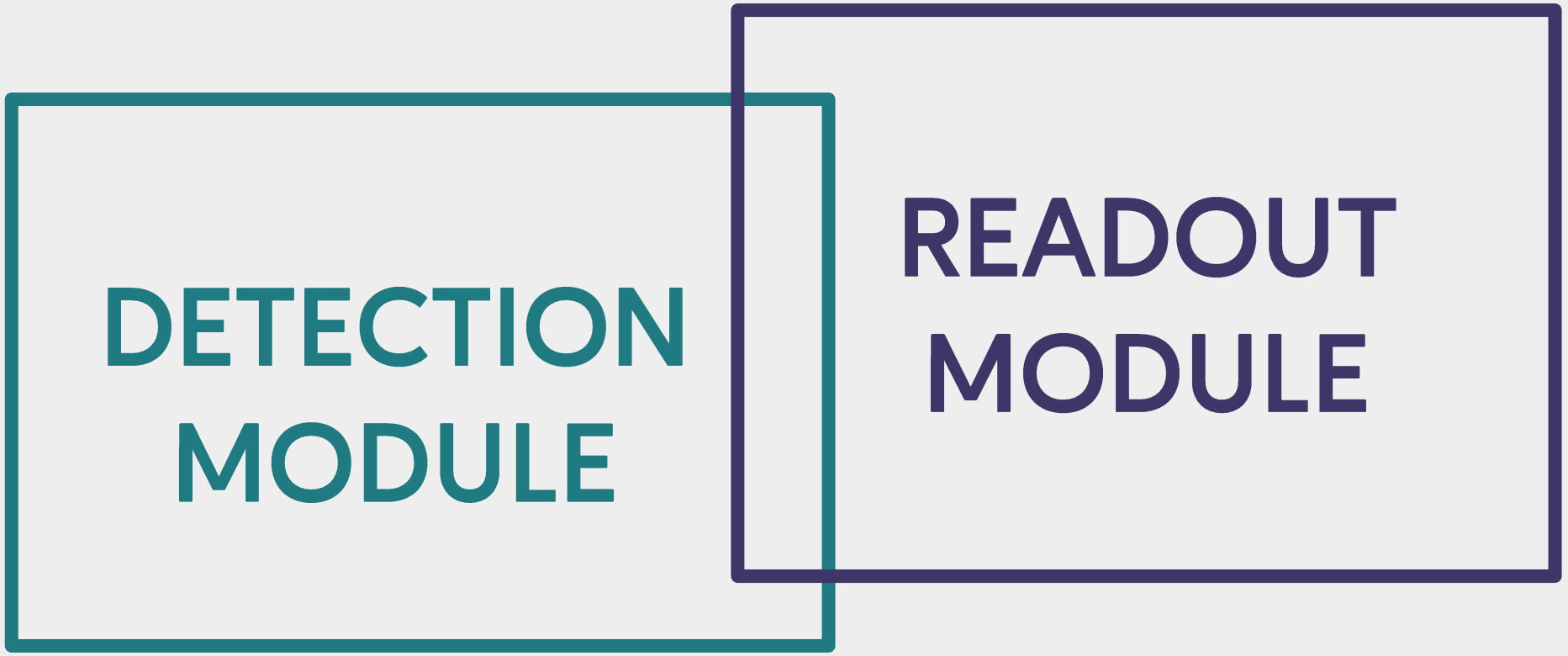
Biomarker

IS6110 gene

Safety

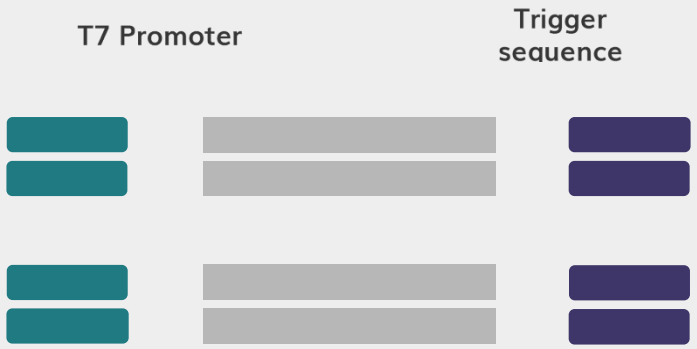
Cell free system

2 MODULES



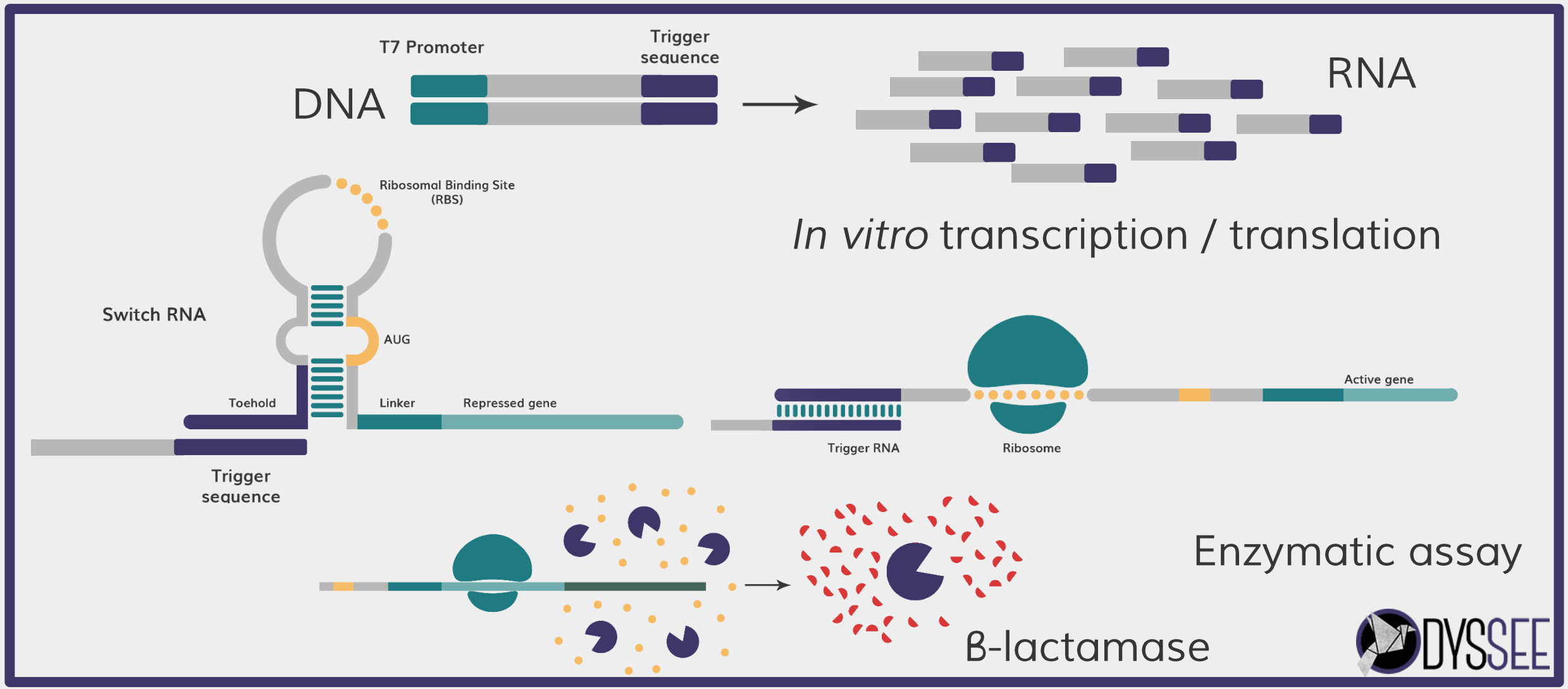
DETECTION MODULE

Recombinase Polymerase Amplification (RPA)



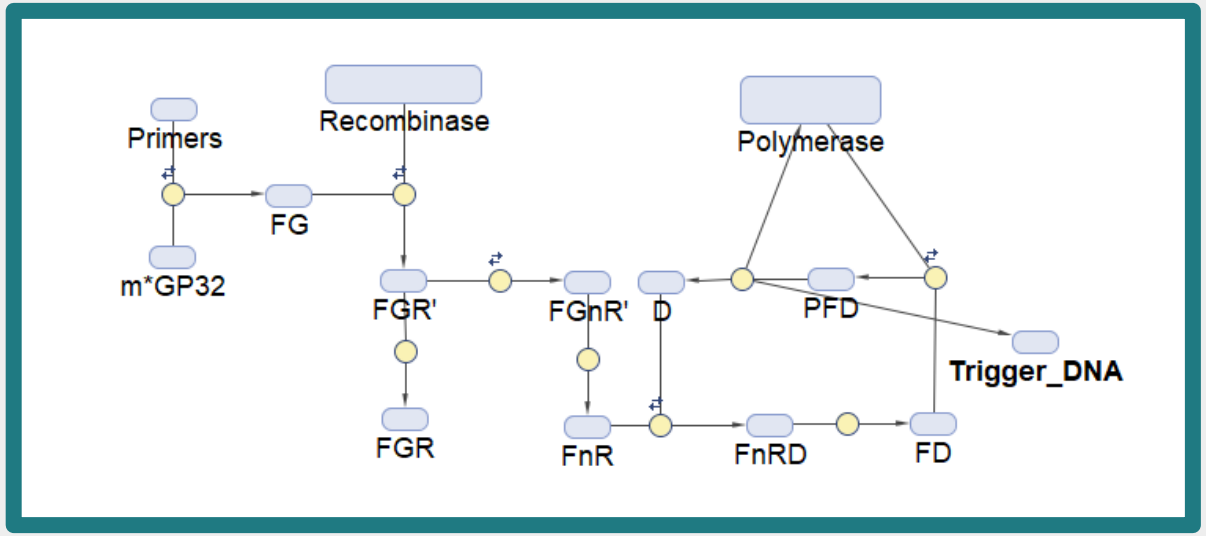
DYSSEE

READOUT MODULE

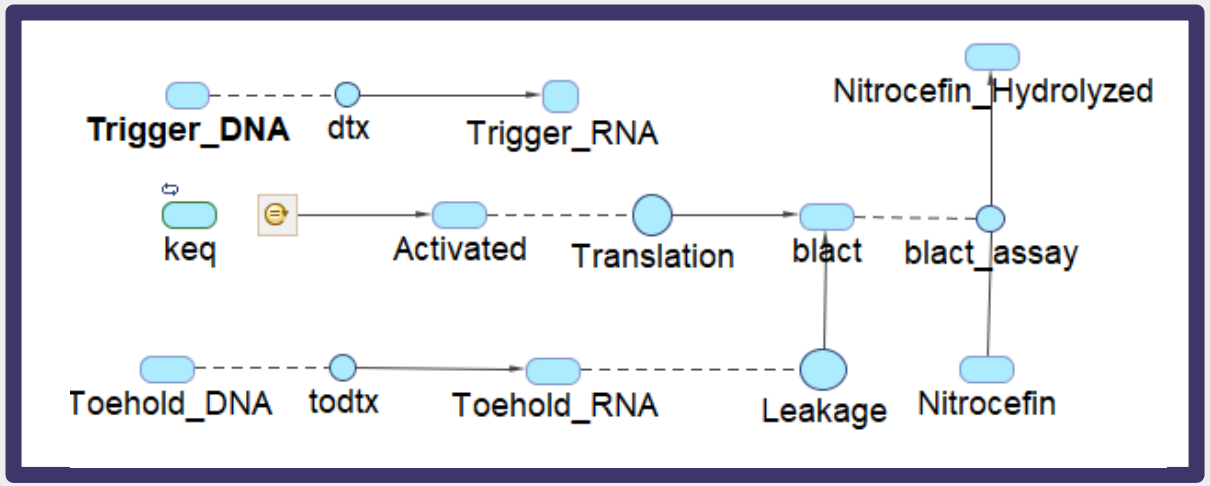


Project Design.

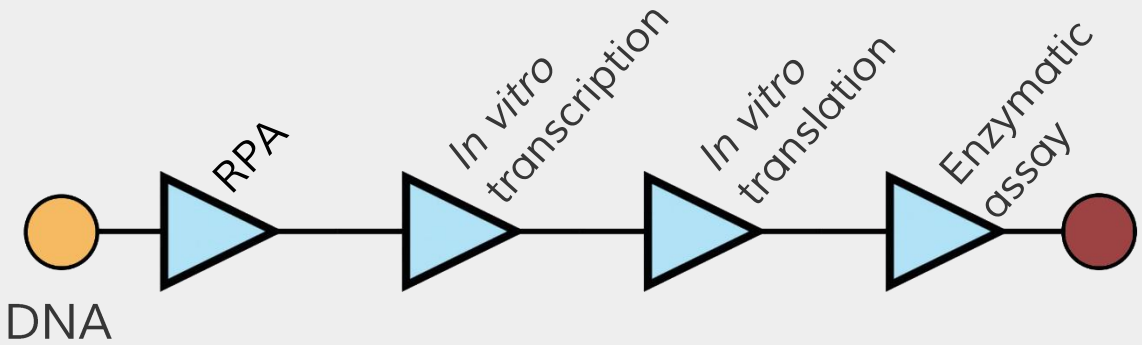
2 MODULE SYSTEM



DETECTION MODULE.



READOUT MODULE.

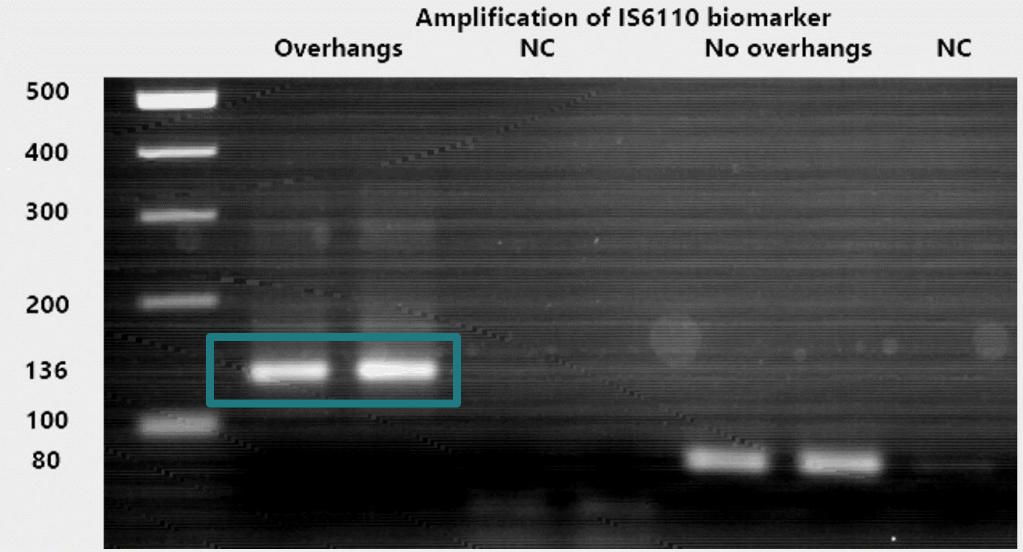


Project Design.

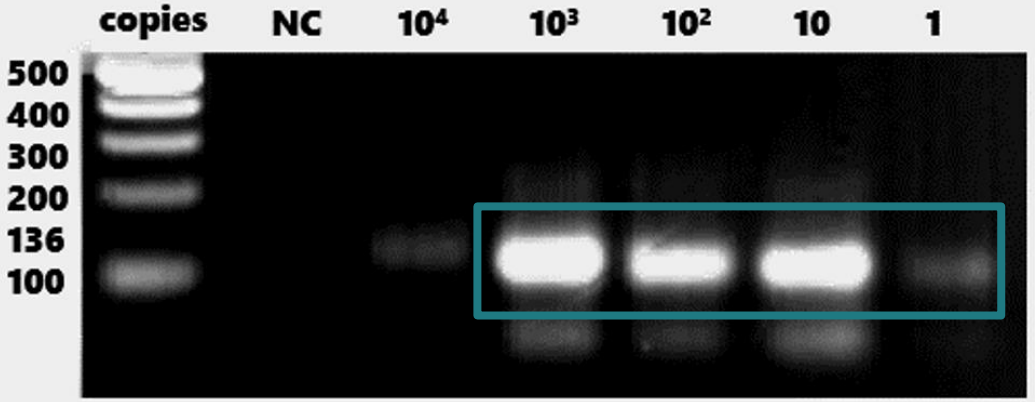
Results.

Results.

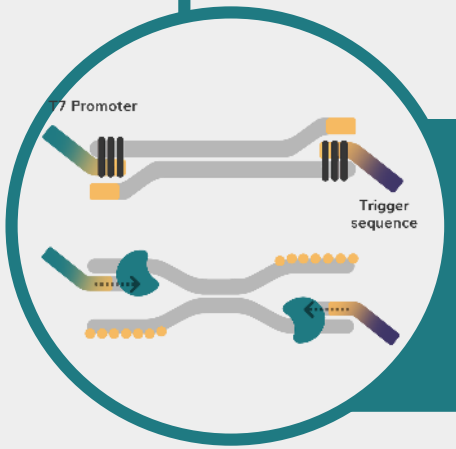
DETECTION MODULE
Validating the sensitivity



PCR amplification



RPA amplification



Optimal Conditions

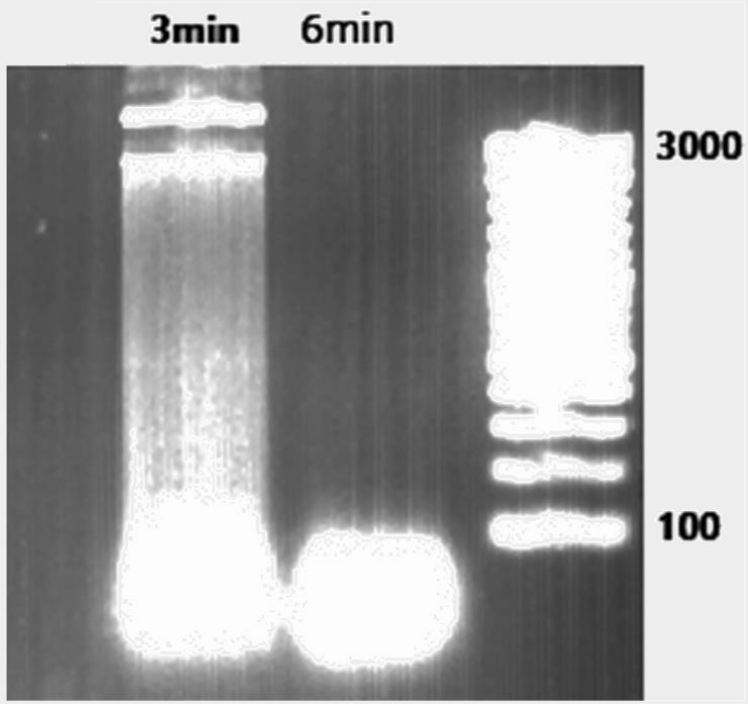
5 minutes | 42 ºC

DYSSEE

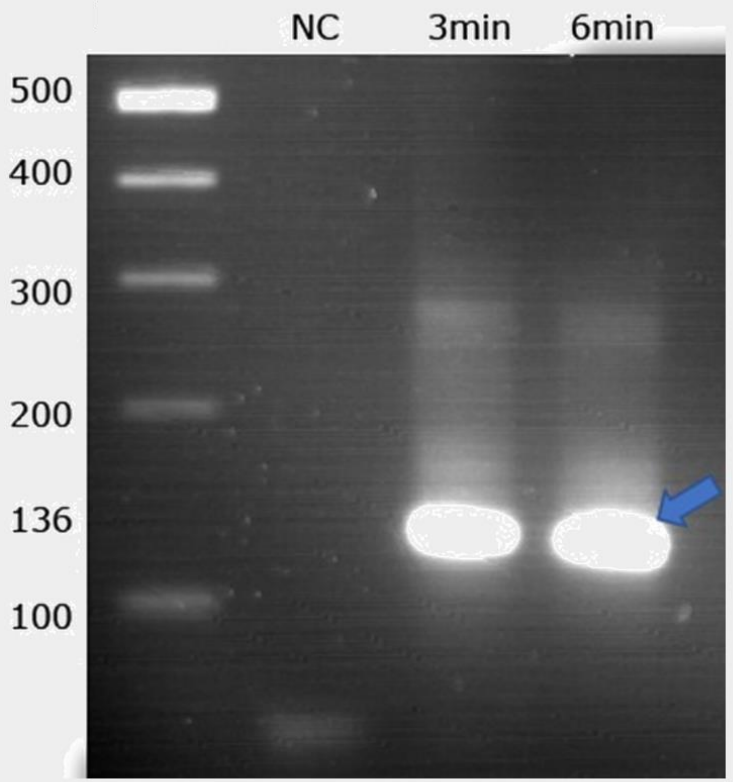
Results.

DETECTION MODULE

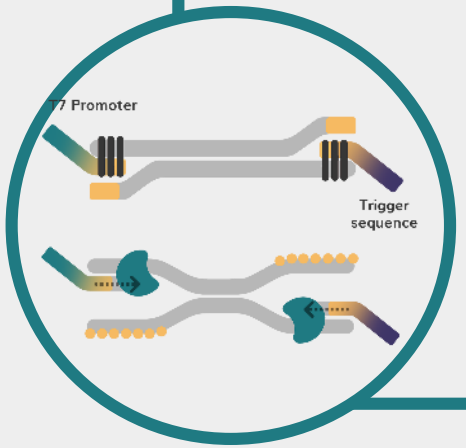
Validating the functionality



Random fragmentation of IS6110 using DNase1



Amplification of the fragmented part

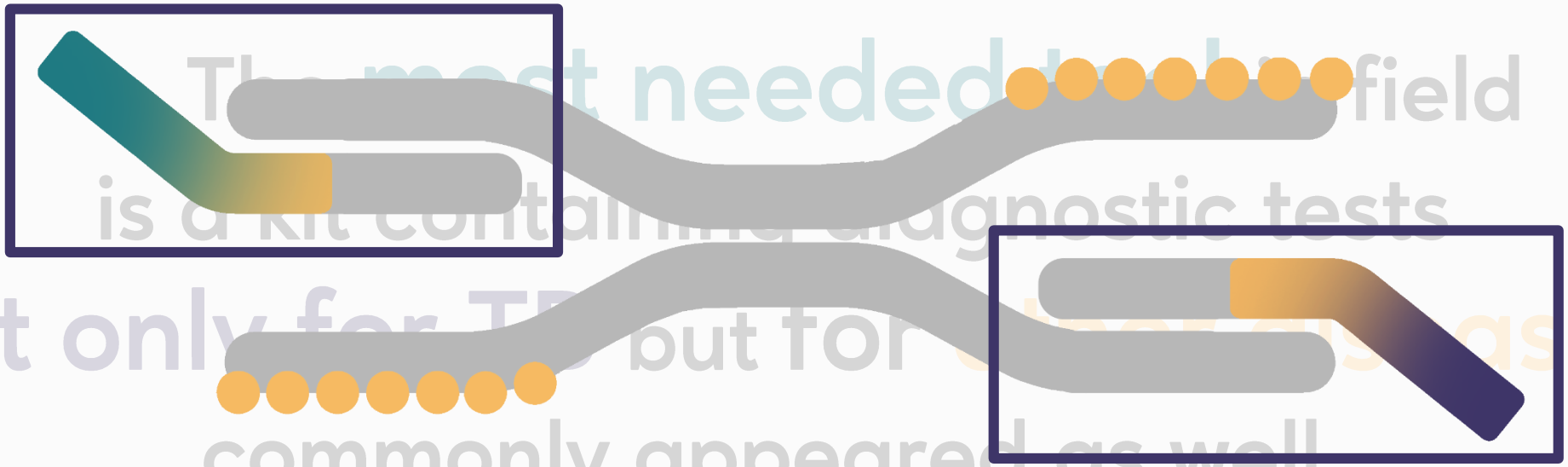


DYSSEE

The most needed tool in field
is a kit containing diagnostic tests
not only for TB but for other diseases
commonly appeared as well.

Dr. Apostolos Veizis

MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS



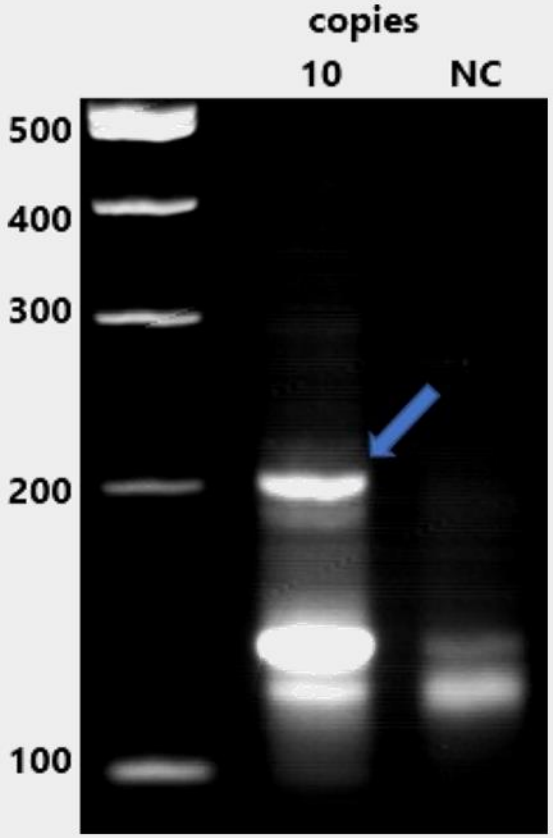
The most needed tool in the field
is a kit containing diagnostic tests
not only for TB but for other diseases
commonly appeared as well.

Dr. Apostolos Veizis

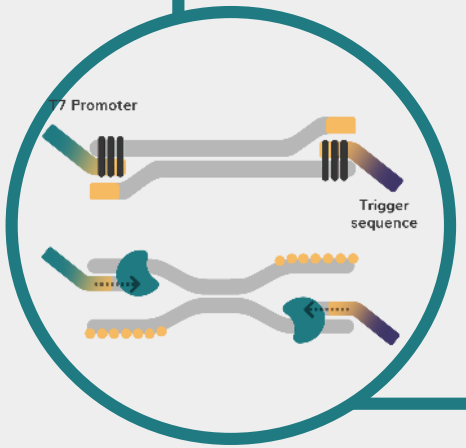
MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS

DETECTION MODULE

Validating the universality

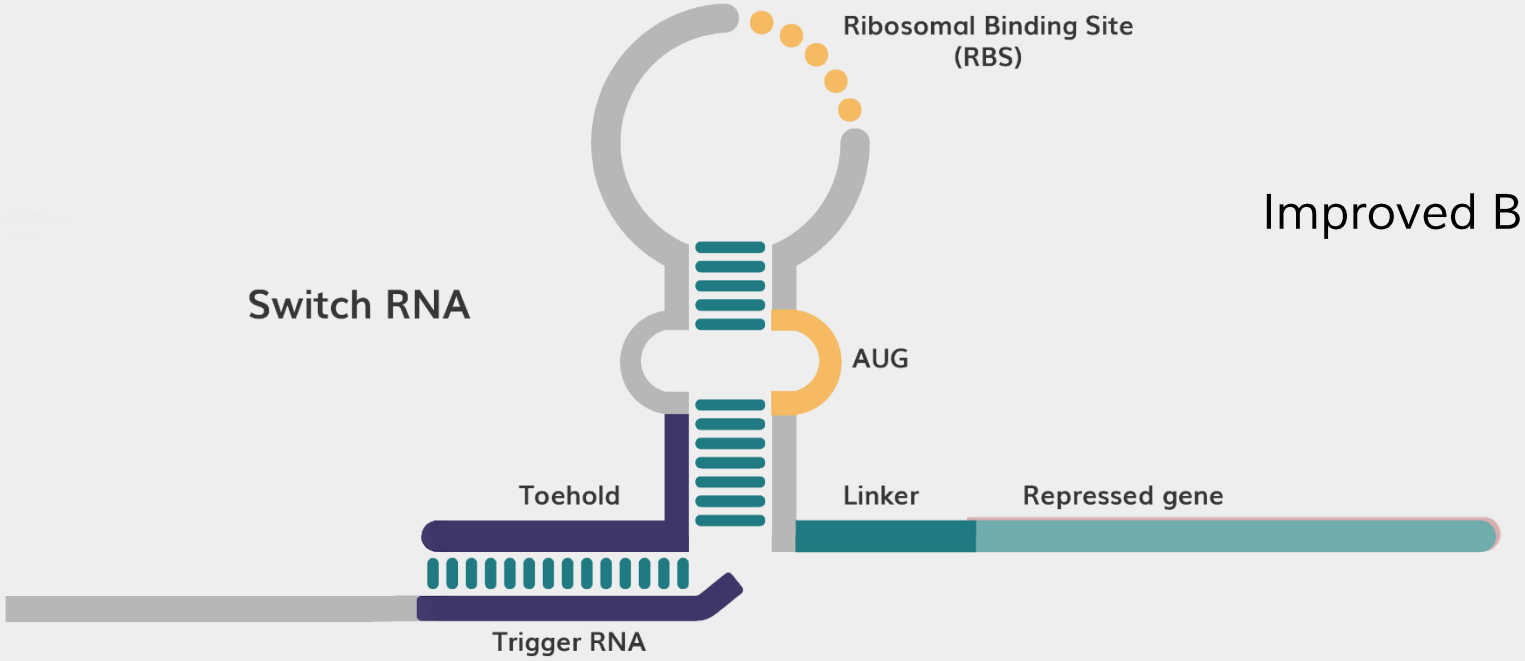


Detection of an HBV genome fragment using RPA

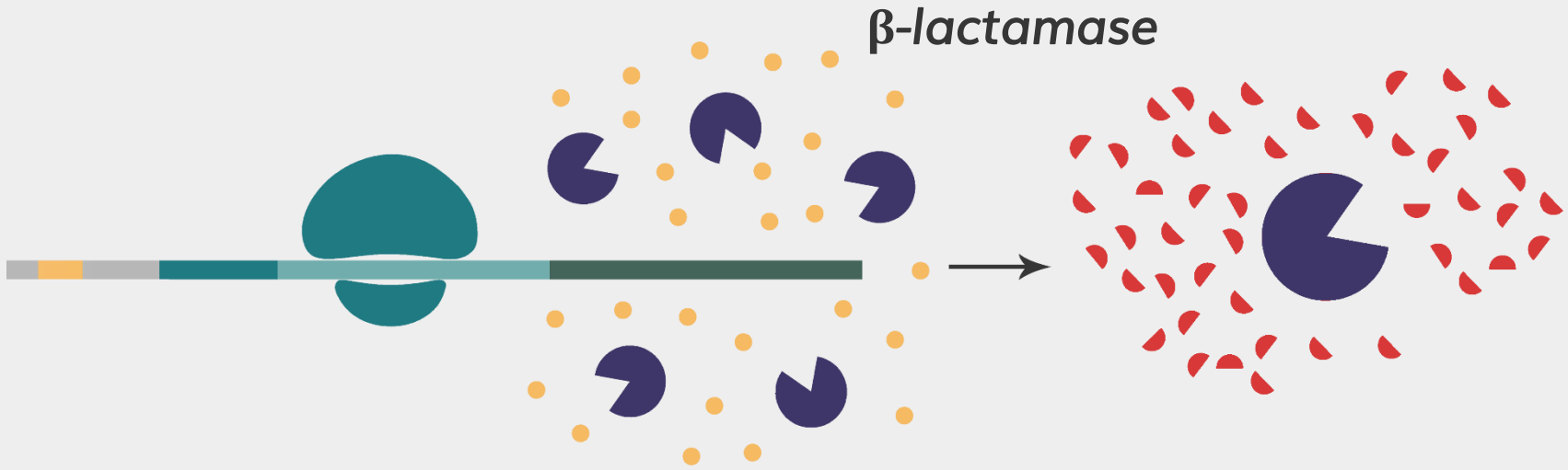


DYSSEE

READOUT MODULE



Improved BioBrick

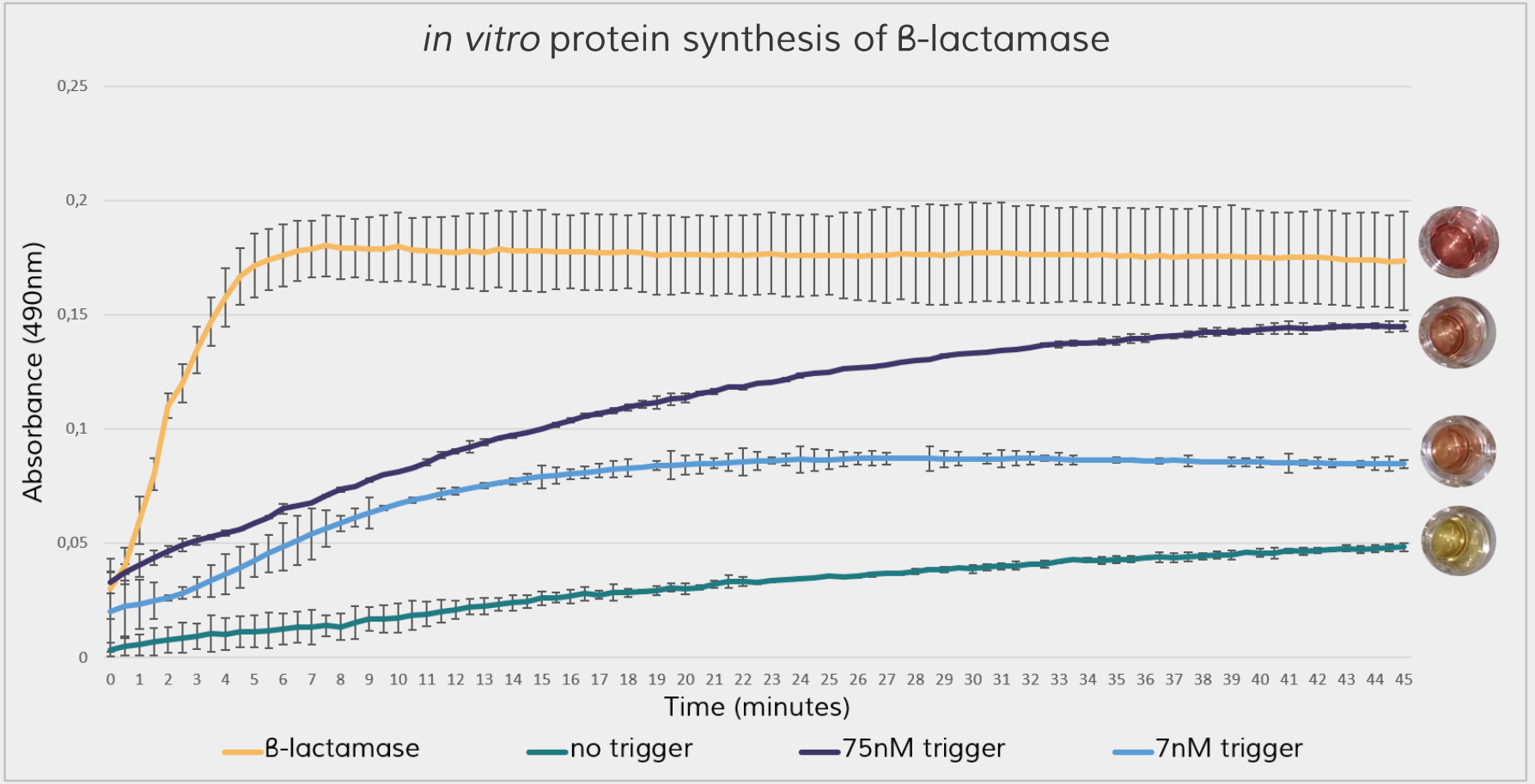


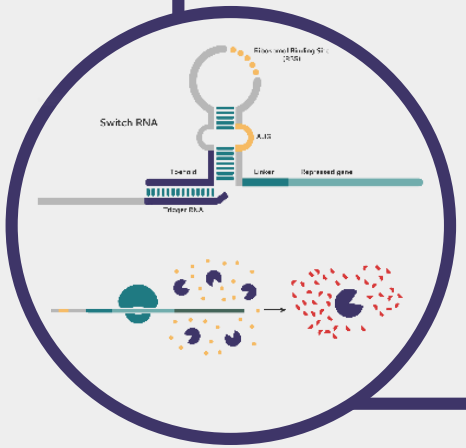
DYSSEE

Results.

READOUT MODULE

Validation



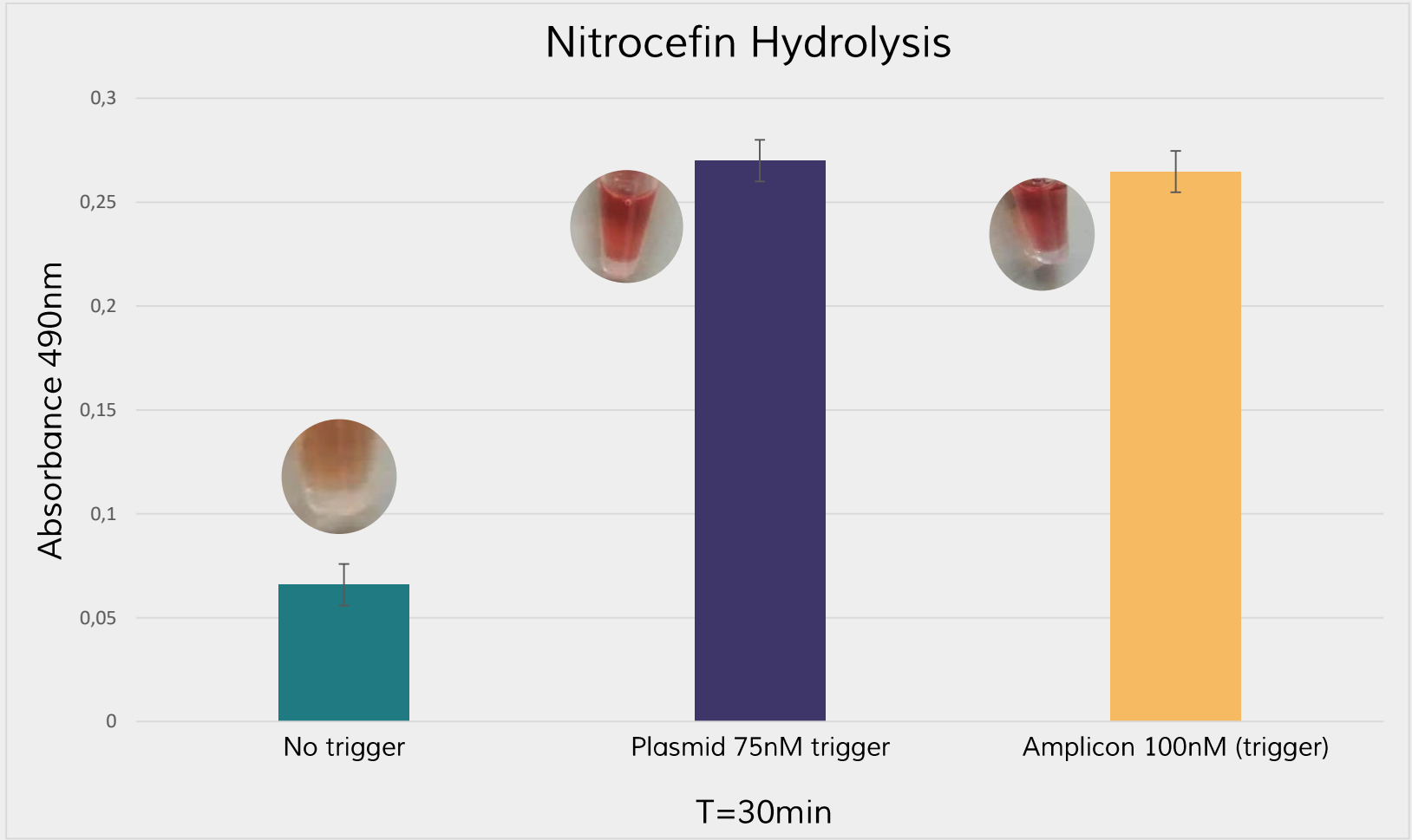


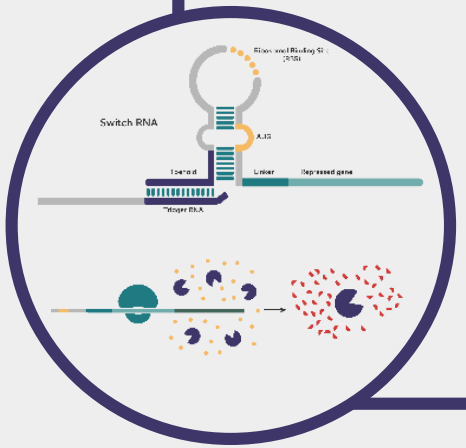
DYSSEE

Results.

READOUT MODULE

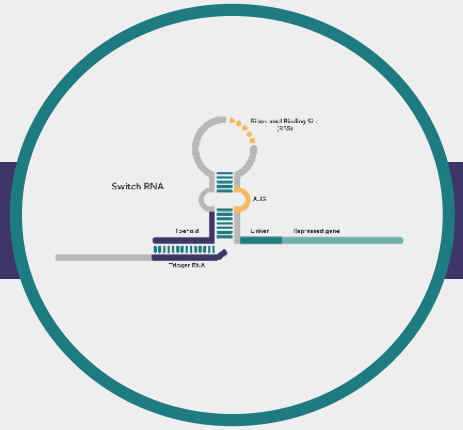
Validation





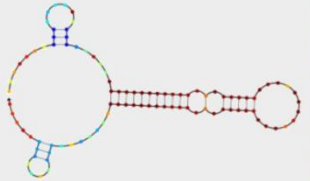
READOUT MODULE

Engineering new toehold switches



hyperthermophile organisms

NUPACK

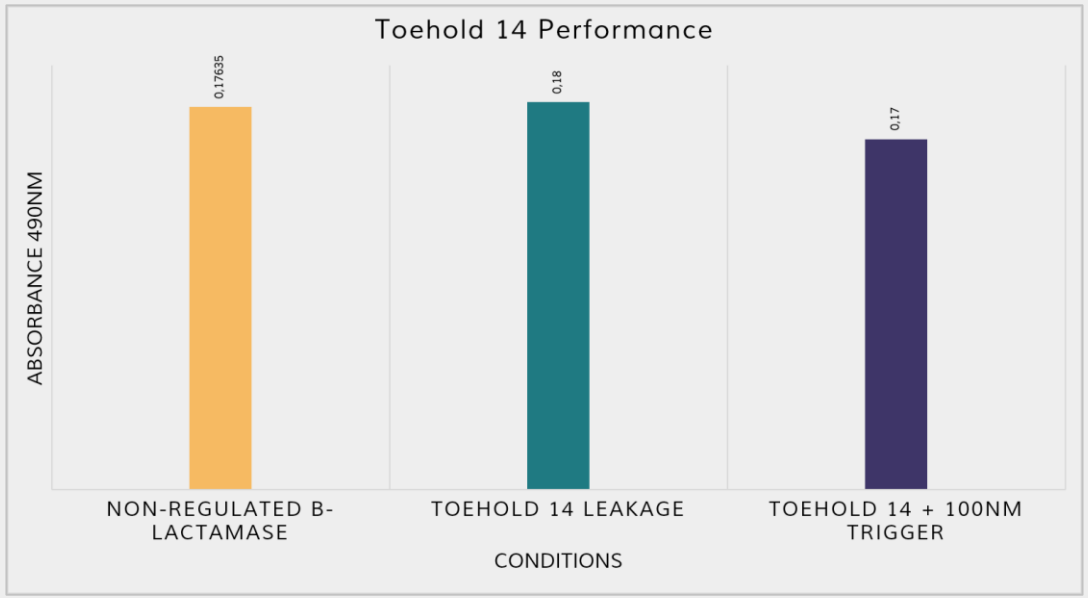


DYSSEE

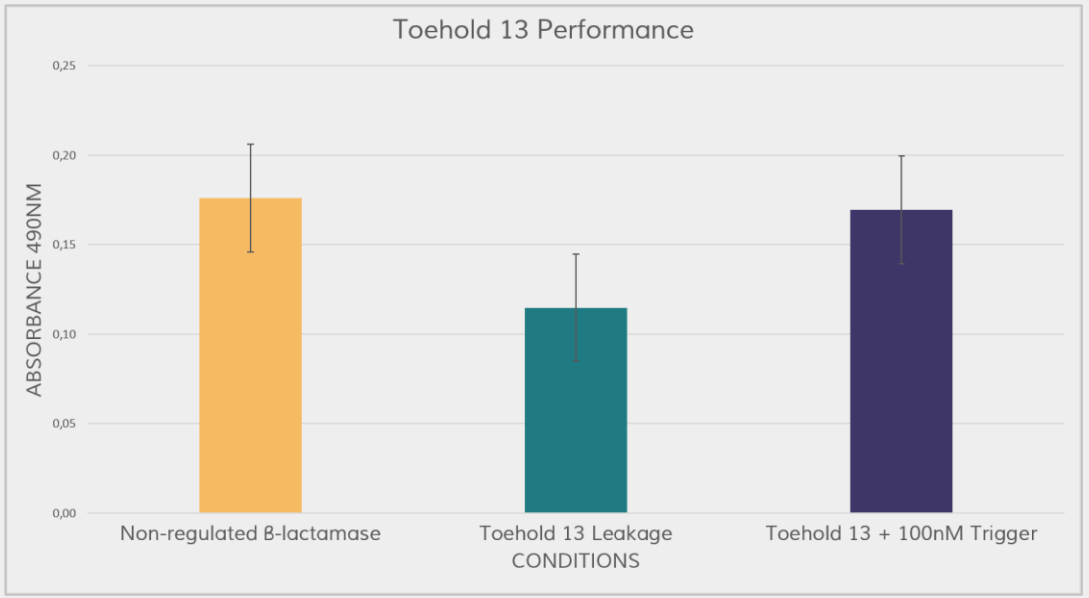
Results.

READOUT MODULE

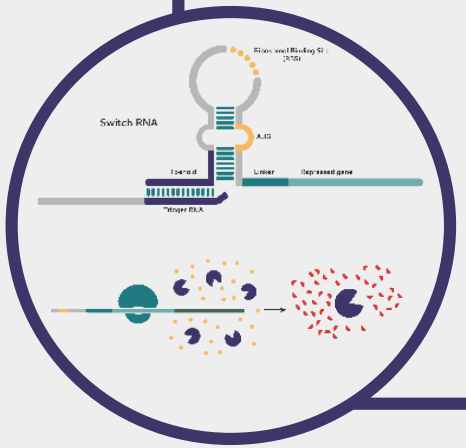
Validation



Toehold 14



Toehold 13



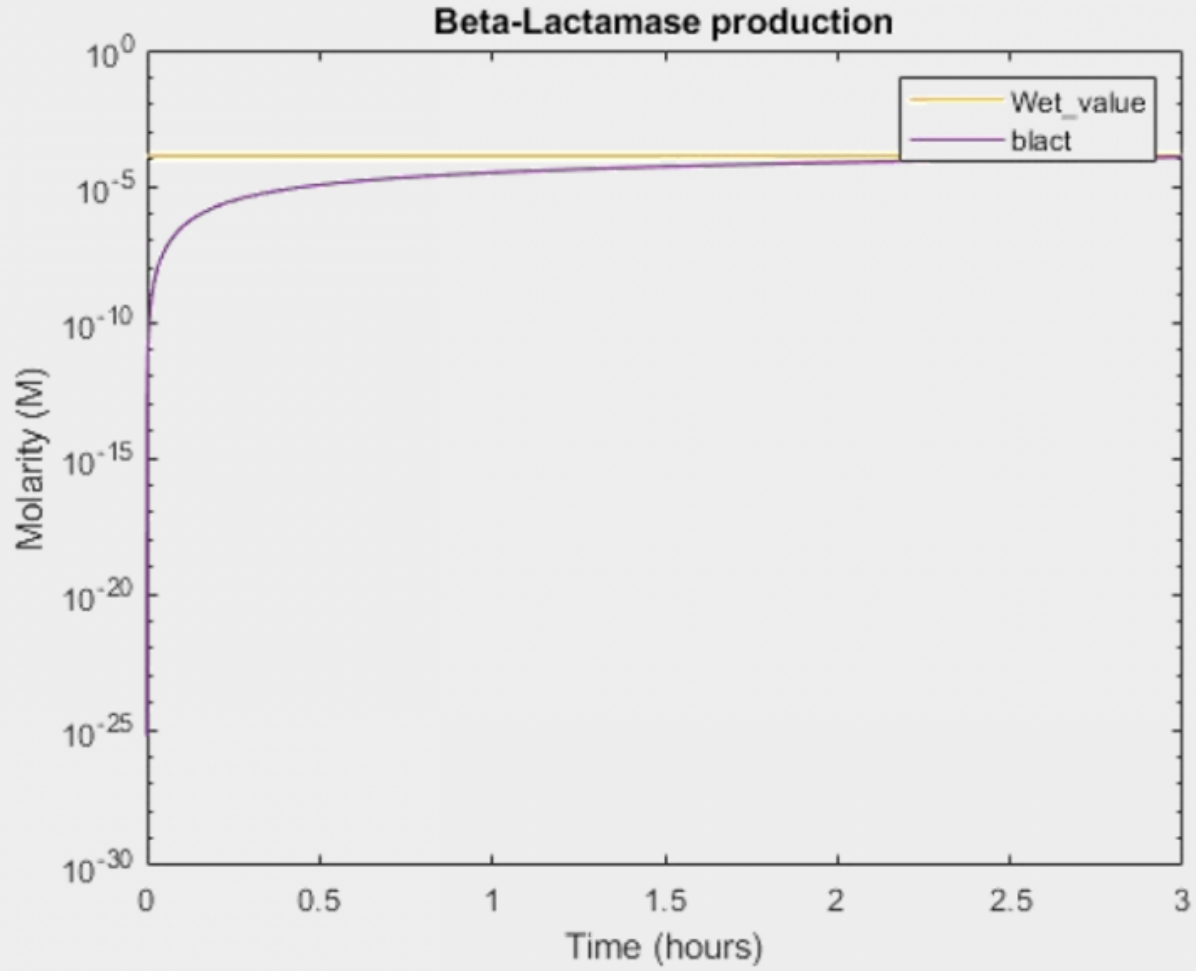
READOUT MODULE

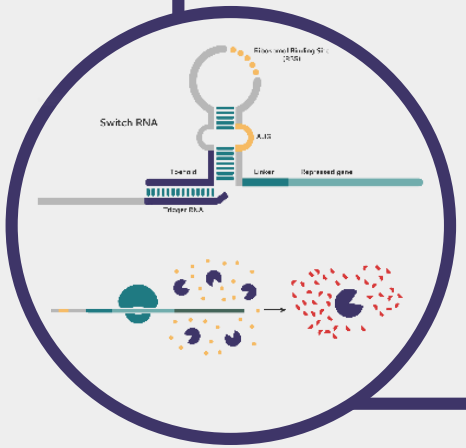
Modeling Results

Results.

READOUT MODULE

Minimum Time Prediction

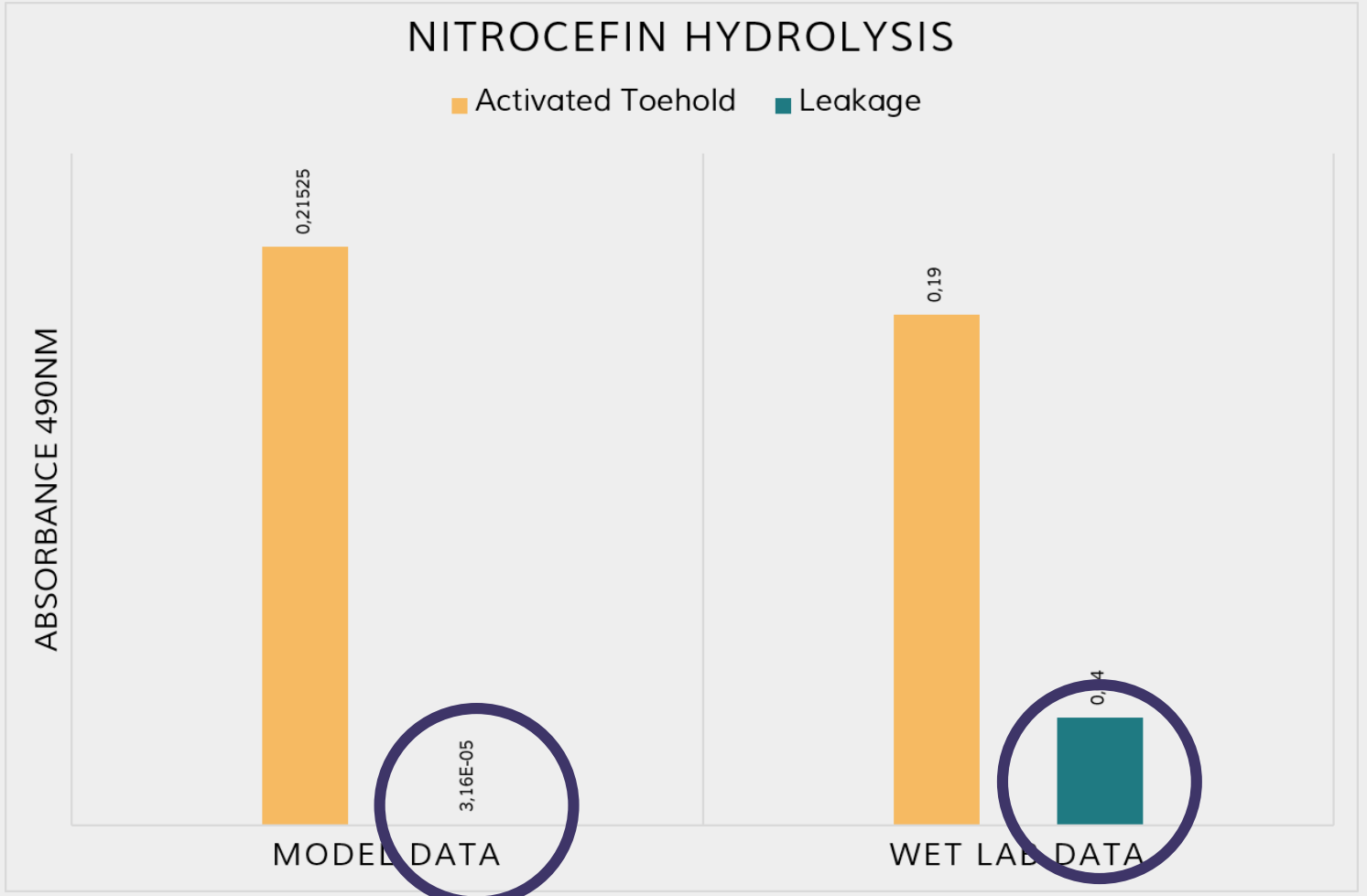


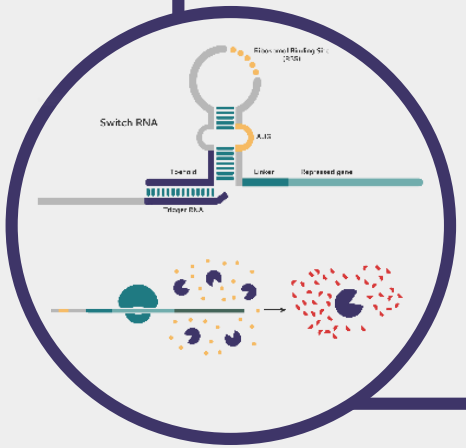


Results.

READOUT MODULE

Minimum Time Prediction



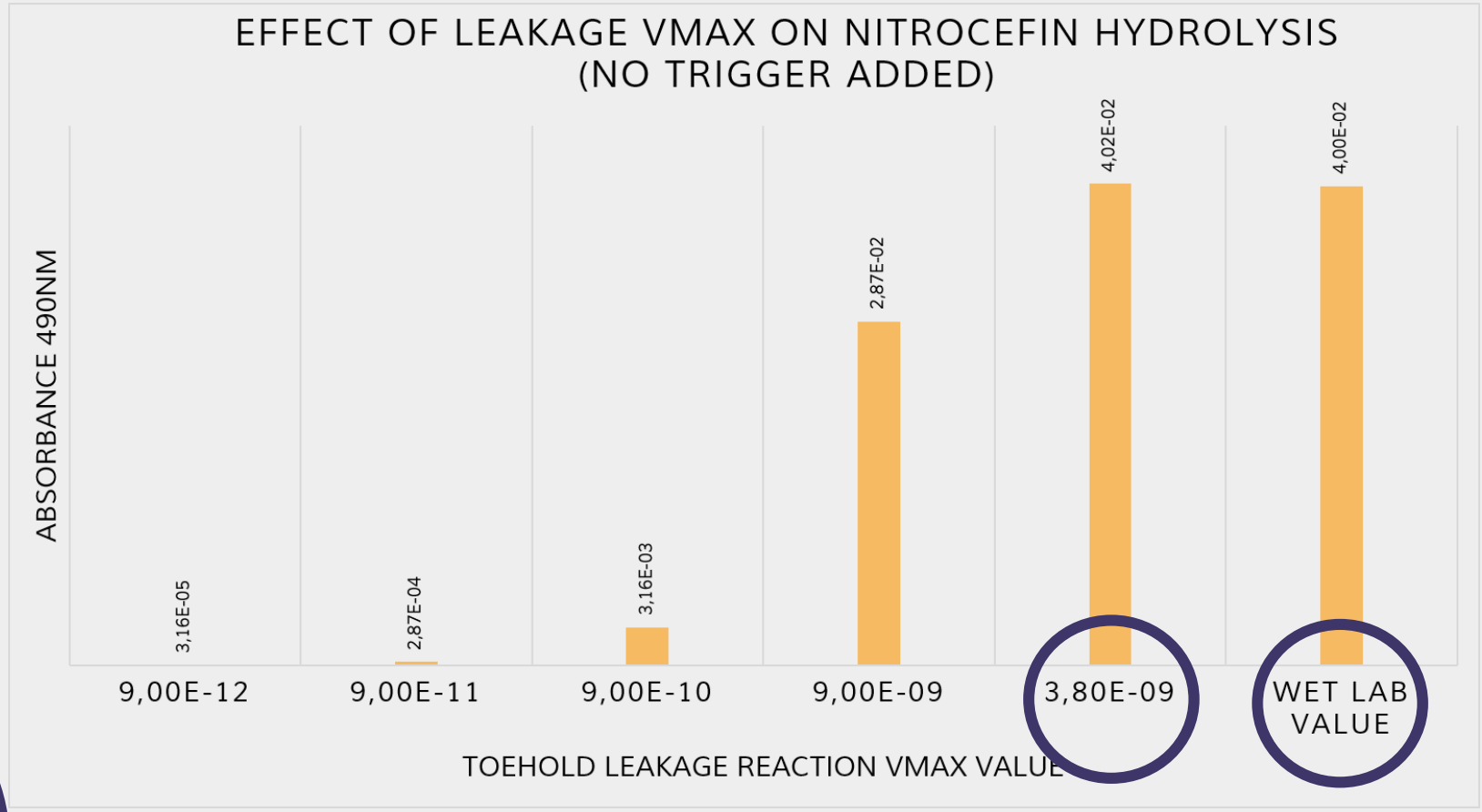


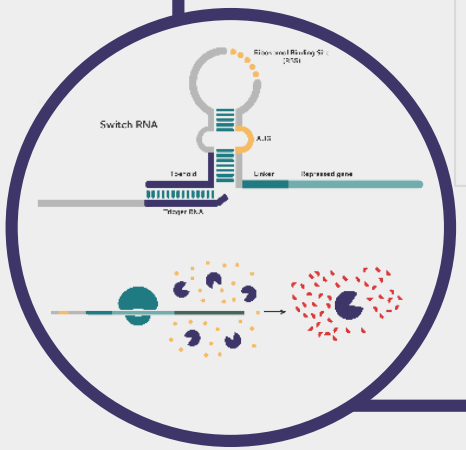
DYSSEE

Results.

READOUT MODULE

Calibration



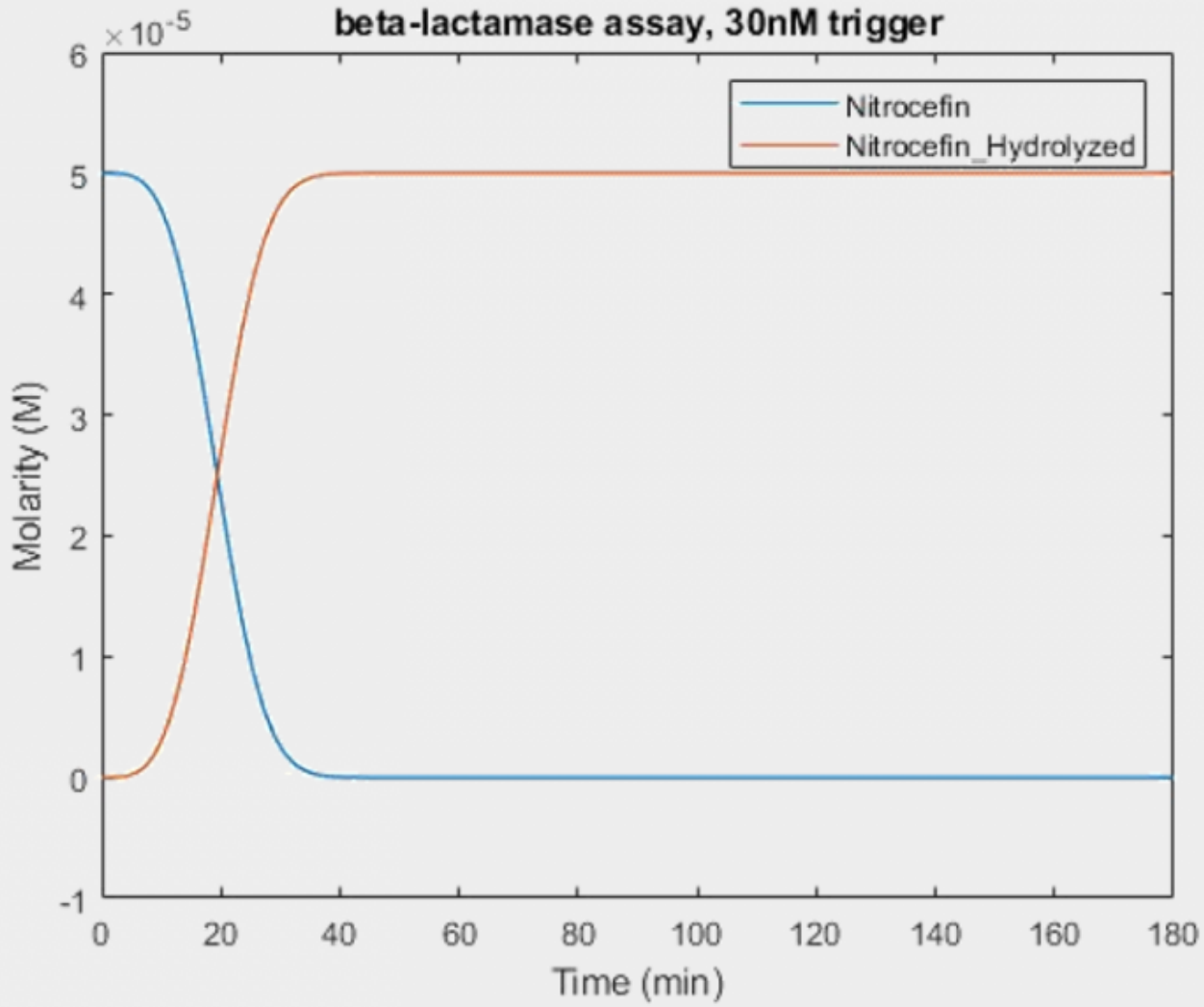


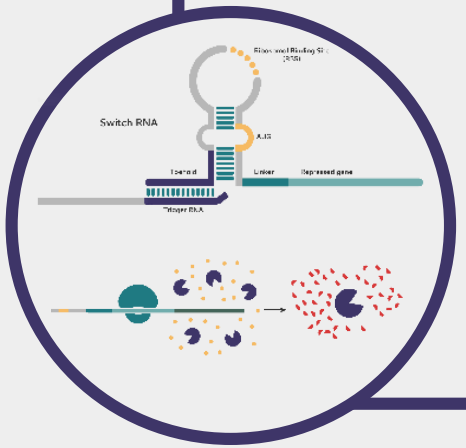
DYSSEE

Results.

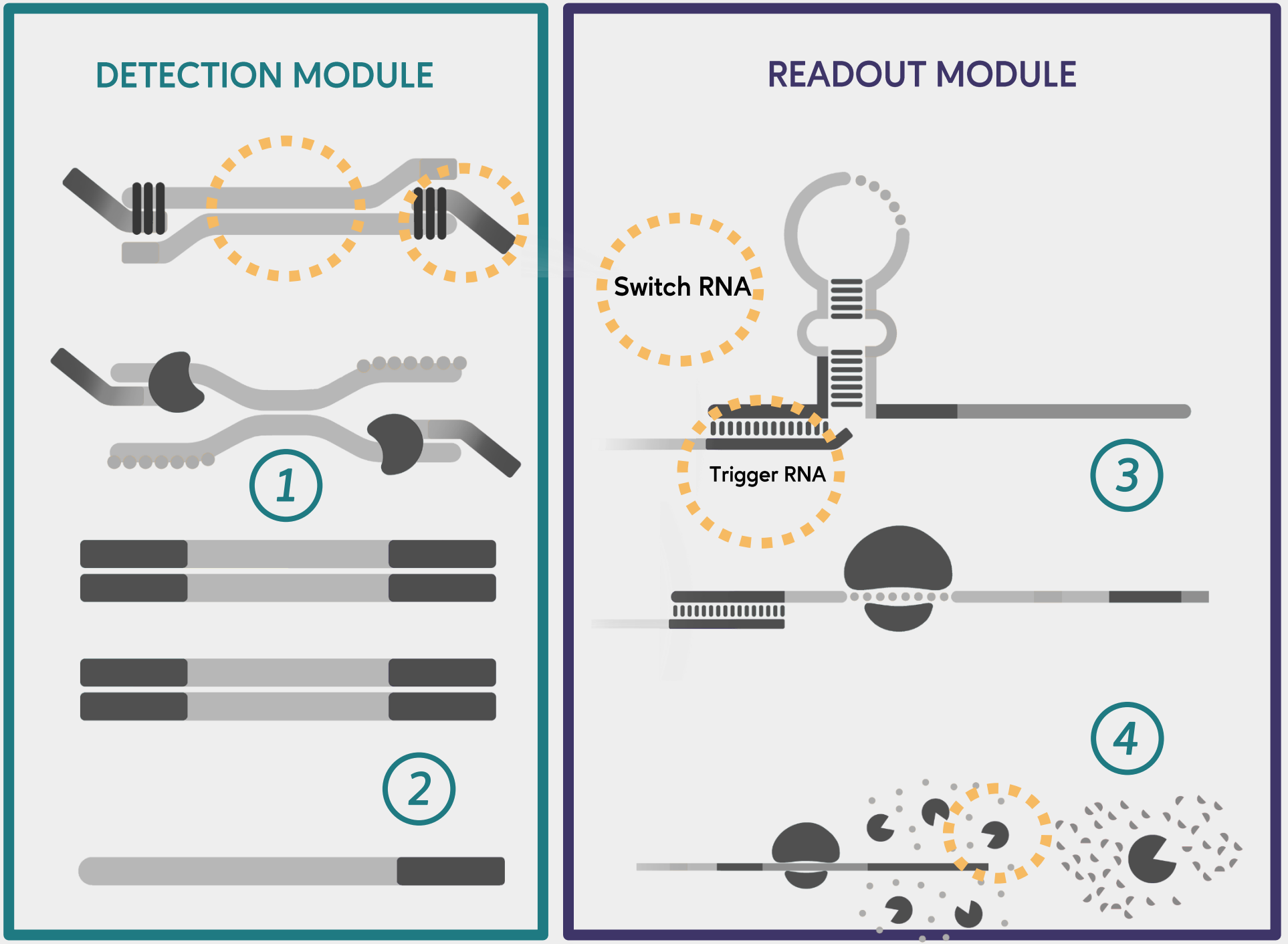
READOUT MODULE

Minimum Time Prediction





DYSSEE



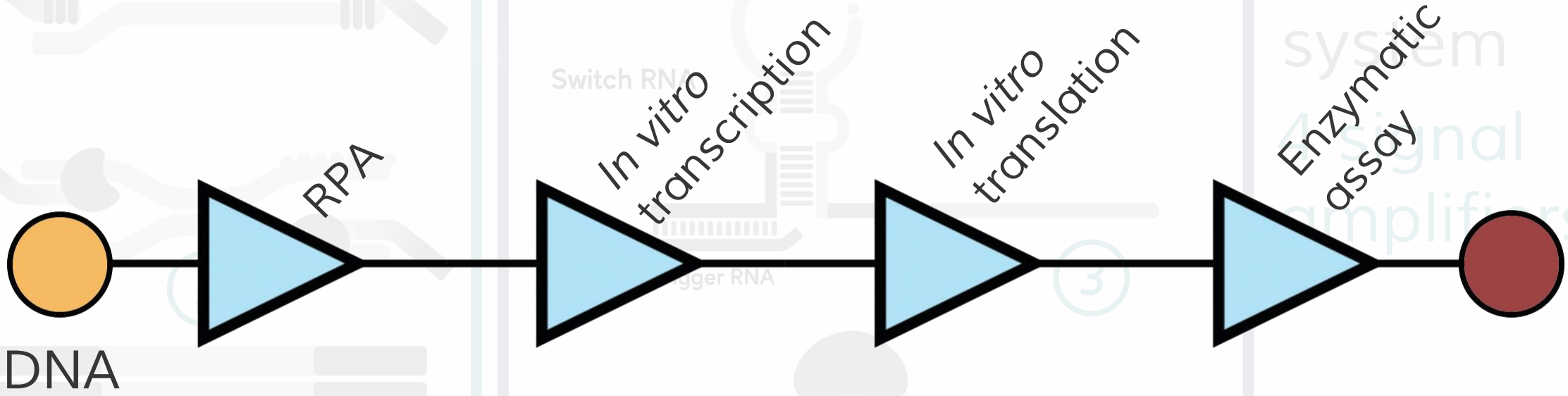
2 modules system

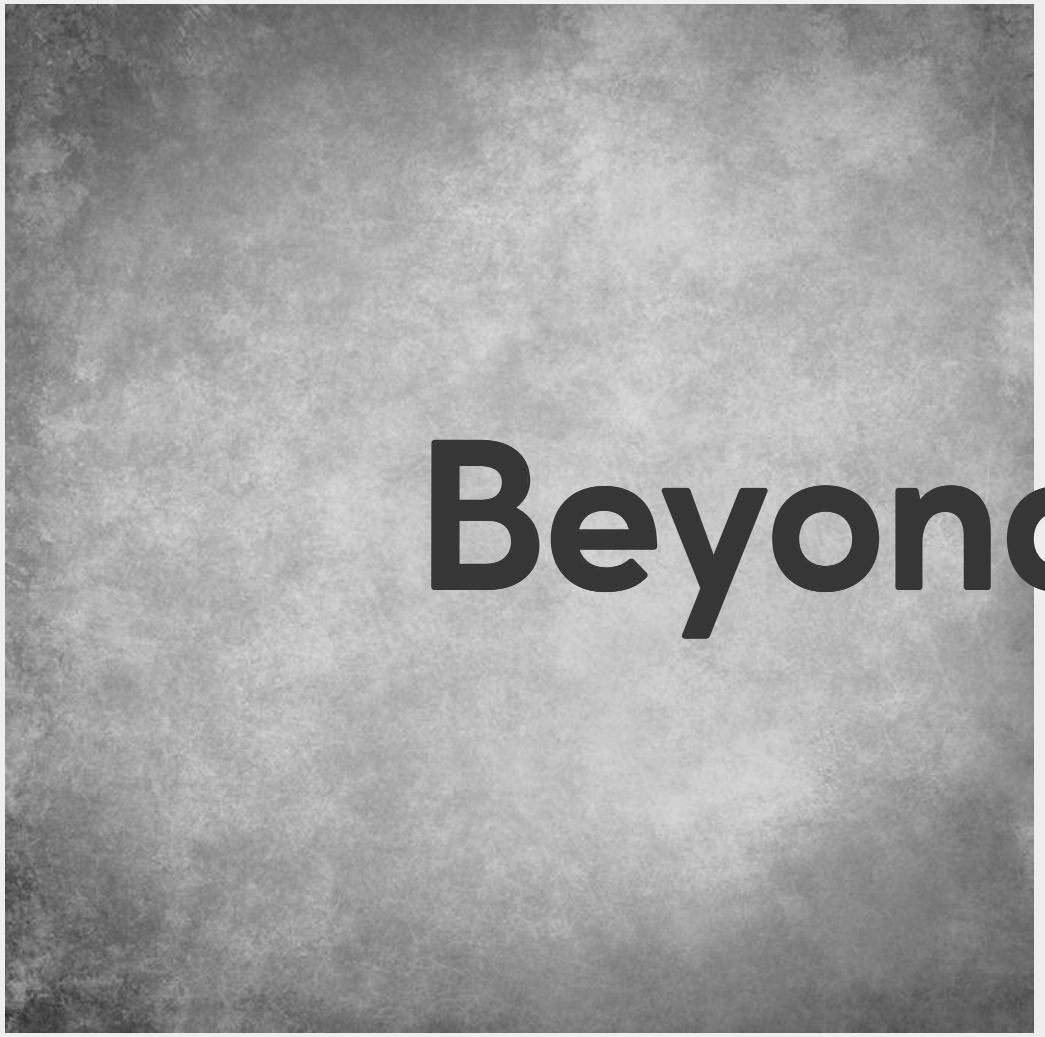
4 signal amplifiers

1 copy of DNA

18 new BioBrick parts

4 signal amplifiers





Beyond the Lab.

Application

EASO

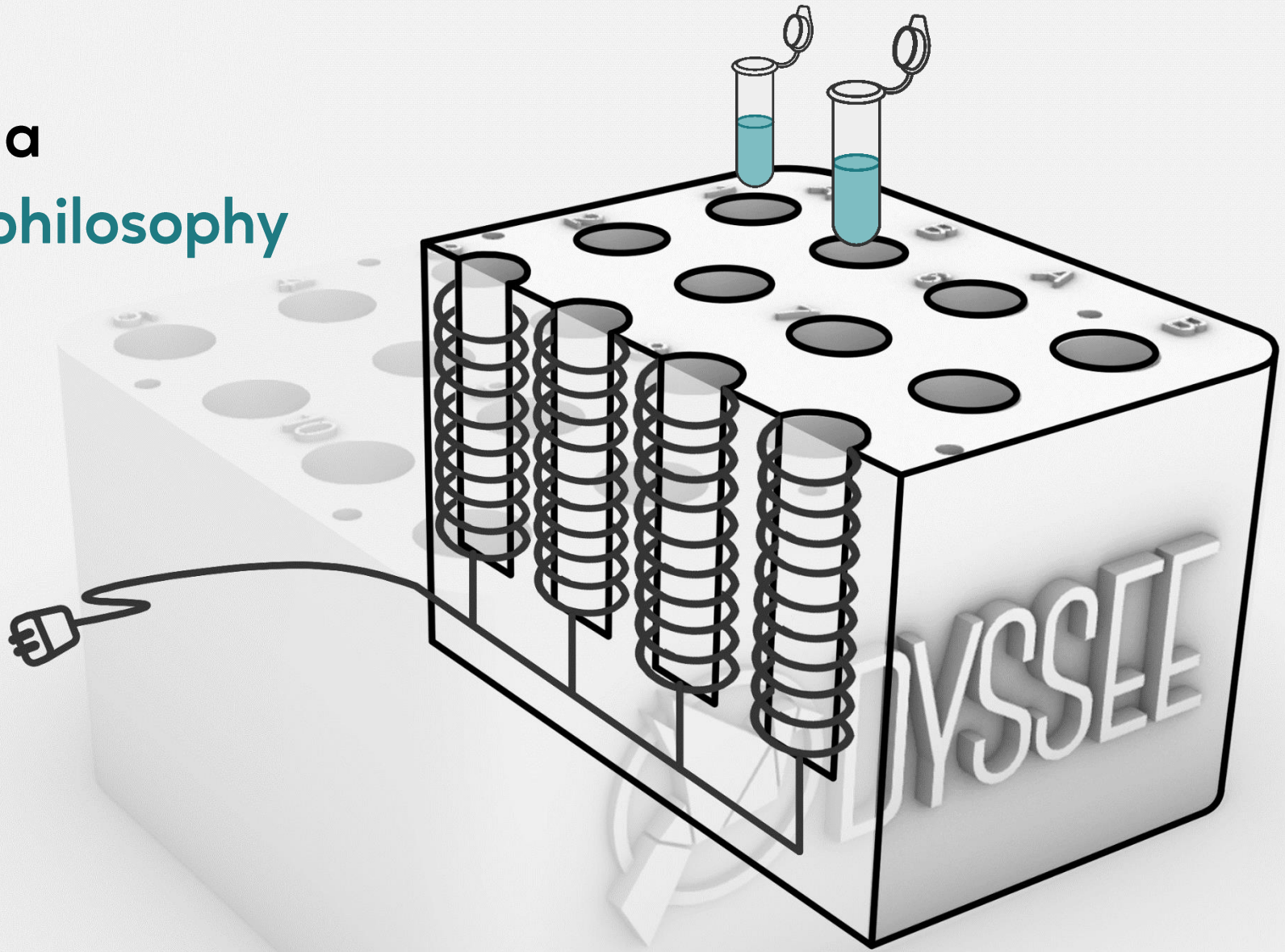
IOM
UN MIGRATION

Reception & Identification Centres

Triage test
a screening test

Welcome to a

2 tubes philosophy



Beyond the Lab.

Deployment at a refugee facility

Deployment at a refugee facility

Beyond the Lab.

Product guide

ΕΘΝΙΚΟΣ ΟΡΓΑΝΙΣΜΟΣ
ΔΗΜΟΣΙΑΣ ΥΓΕΙΑΣ

Making our system accessible

Arabic دليلالمنحج

French Fiche produit

Urdu پروڈکٹ گبئیڈ

Beyond the Lab.

Healthcare model

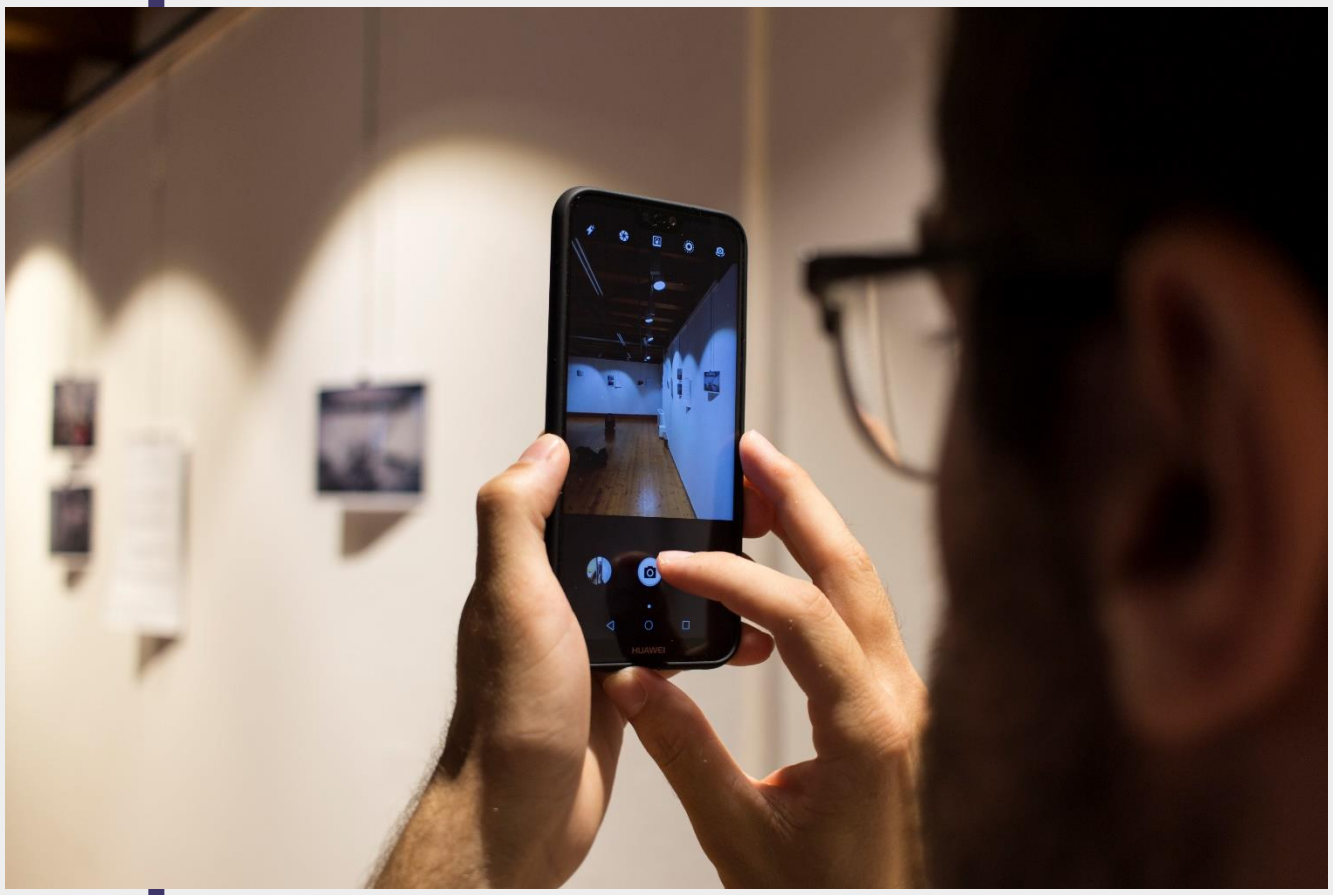
Inclusive, intersectoral & multidisciplinary approach to migration

Beyond the Lab.

Entrepreneurship

reaching
key populations

H.F.R.I.
Hellenic Foundation for Research & Innovation



Education & Public Engagement

Beyond the Lab.


SynArt
by
iGEM Thessaly
DYSSEE

SynArt by iGEM Thessaly

SynArt by iGEM Thessaly

SynArt by iGEM Thessaly

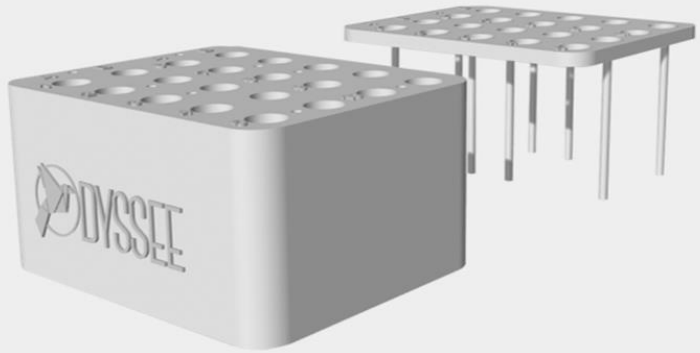
Industry

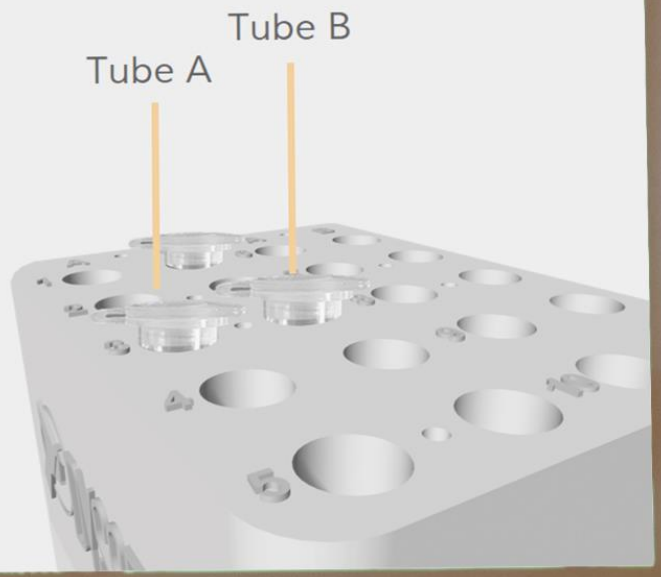
Implementation

DYSSEE

Welcome to the
2tubes Philosophy

Simple. Safe. Specific.





Science without borders

DYSSEE

First Greek Meetup

iGEM GREEK MEETUP

iGEM Thessaly

iGEM Athens 2019

iGEM Thessaloniki

DYSSEE

First Greek Meetup

First Greek Meetup

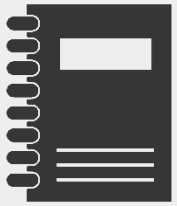
DYSSEE

First Greek Meetup

Achievements

Create a universal platform

Design of Biosafety



Develop a healthcare model

Explore entrepreneurship

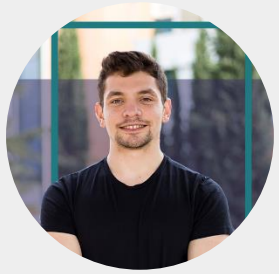
Promote science without borders

The people behind ODYSSEE


Maria


Afroditi


Athina


Nick


Vasiliki


Eleftheria


Nikoleta


Leandros


Xenia


Theodore

ODYSSEE

Thank you!

iGEM Thessaly

University of Thessaly — Founded 1984

OMIC ENGINE

- PIs, Instructors & Advisors
- Laboratory of Plant & Environmental Biotechnology
- Laboratory of Molecular Biology & Genomics

ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ IKY

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Lab Supplies Scientific

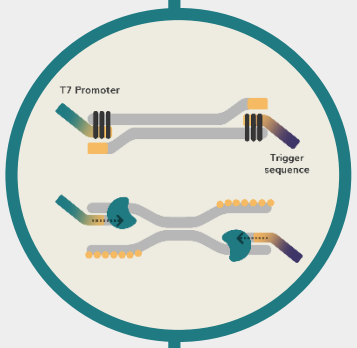
NOVARTIS

ELPEN

ΕΛΛΗΝΙΚΑ ΠΕΤΡΕΛΑΙΑ

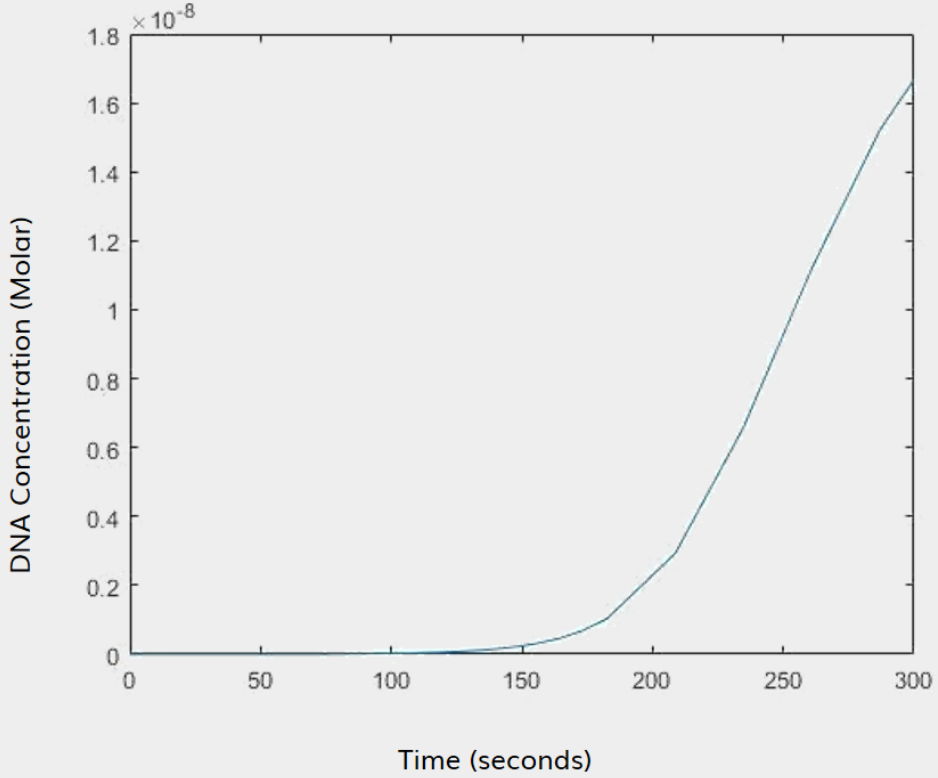
MODULE

DETECTION

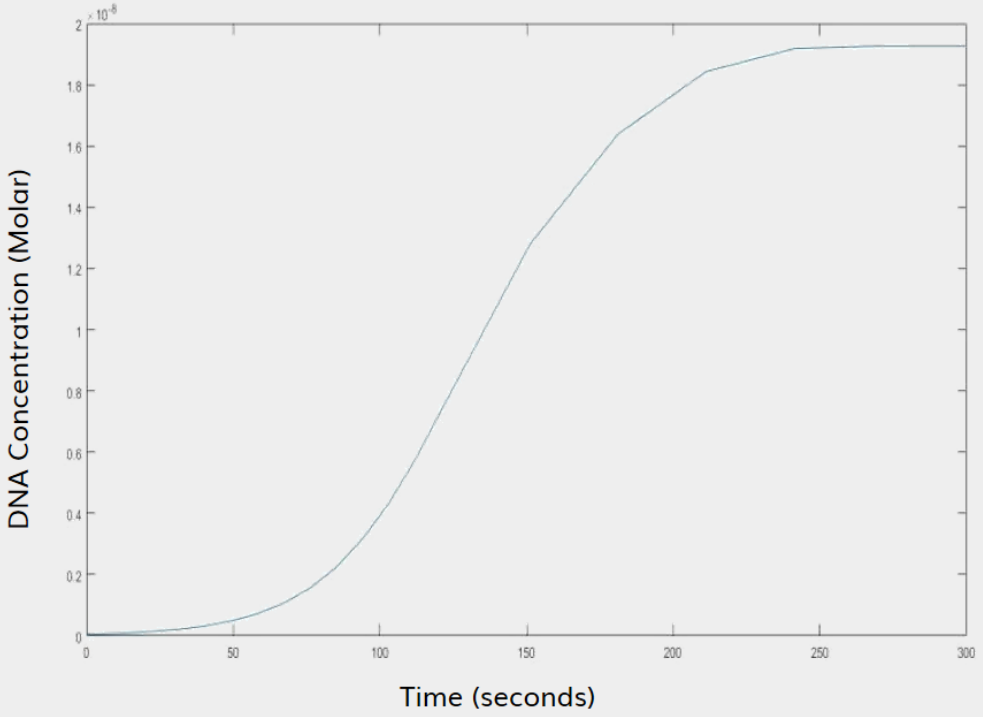


DNA Amplification

Modeling Results



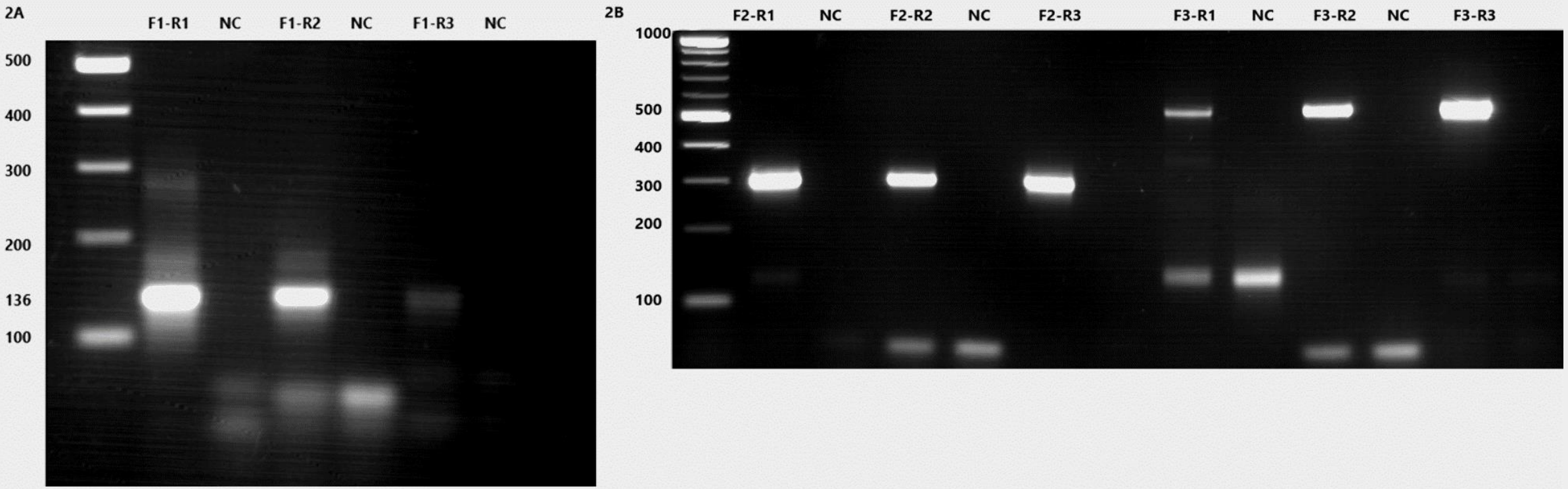
Concentration of amplified DNA (M) using 2.94 10^{-17}M as DNA input during time (sec)



Concentration of amplified DNA (M) using 5.8 10^{-11}M as DNA input during time (sec)

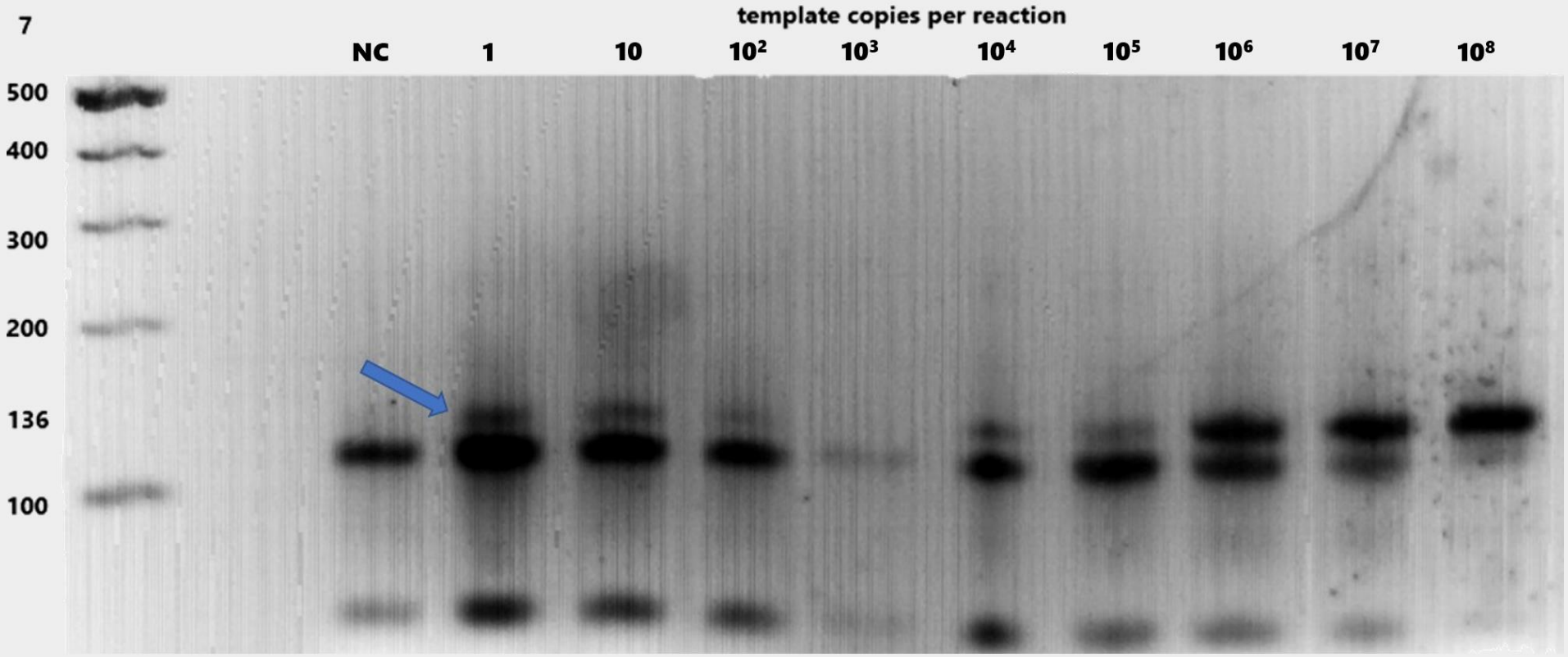
DYSSEE

Primers Screening



A) Primer screening of 3 primer combinations with the 1st Forward primer, which correspond to ~136bp amplified product lengths and different annealing lengths for the reverse primers (32, 36 and 39 bp annealing). **B)** Primer screening of 6 primer combinations with the 2nd and 3rd Forward primer, which correspond to ~306 and 556bp amplified product lengths and different annealing lengths for the reverse primers (32, 36 and 39 bp annealing).

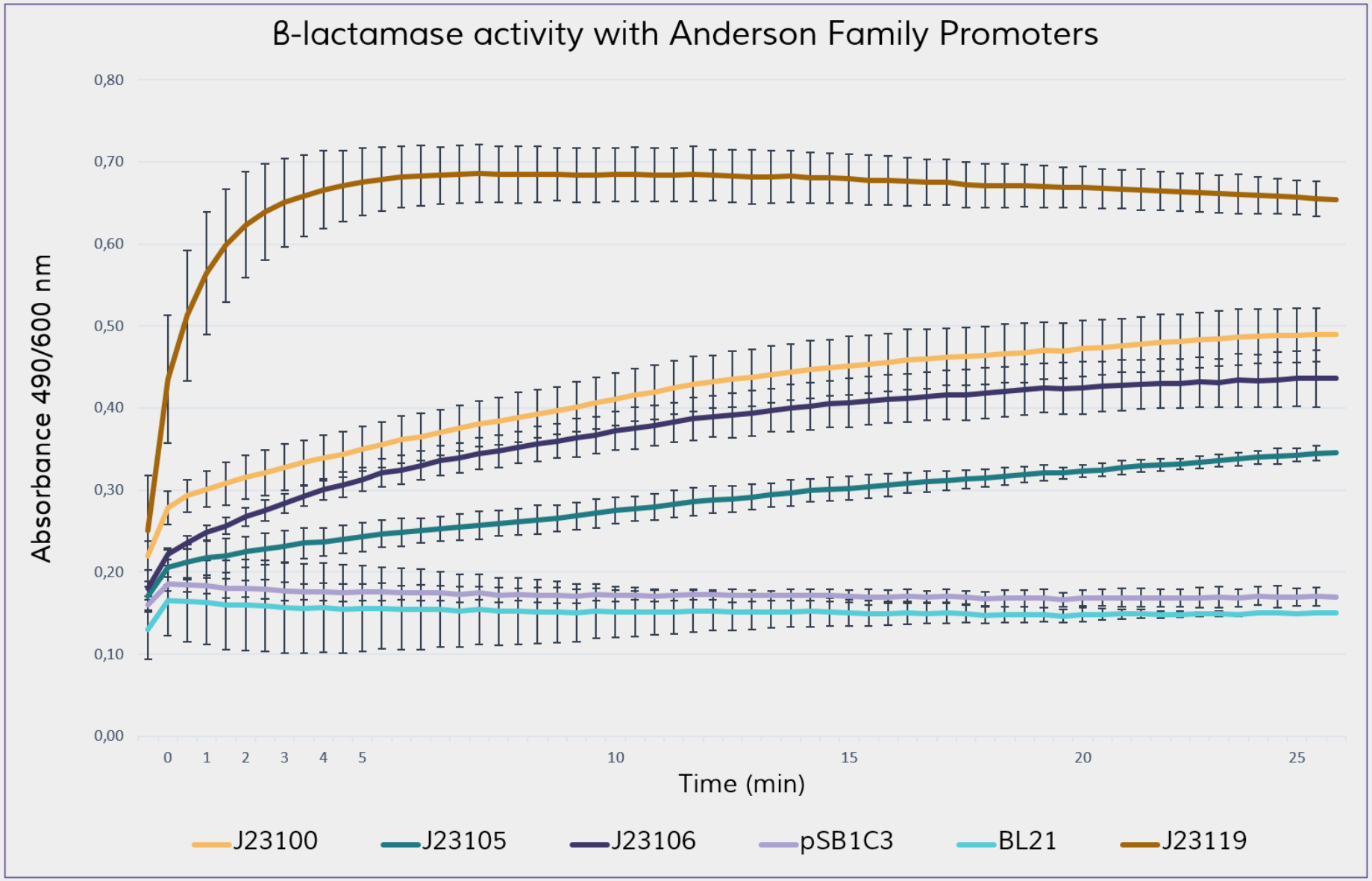
RPA Amplification



Amplification reaction with serial dilutions of our DNA template

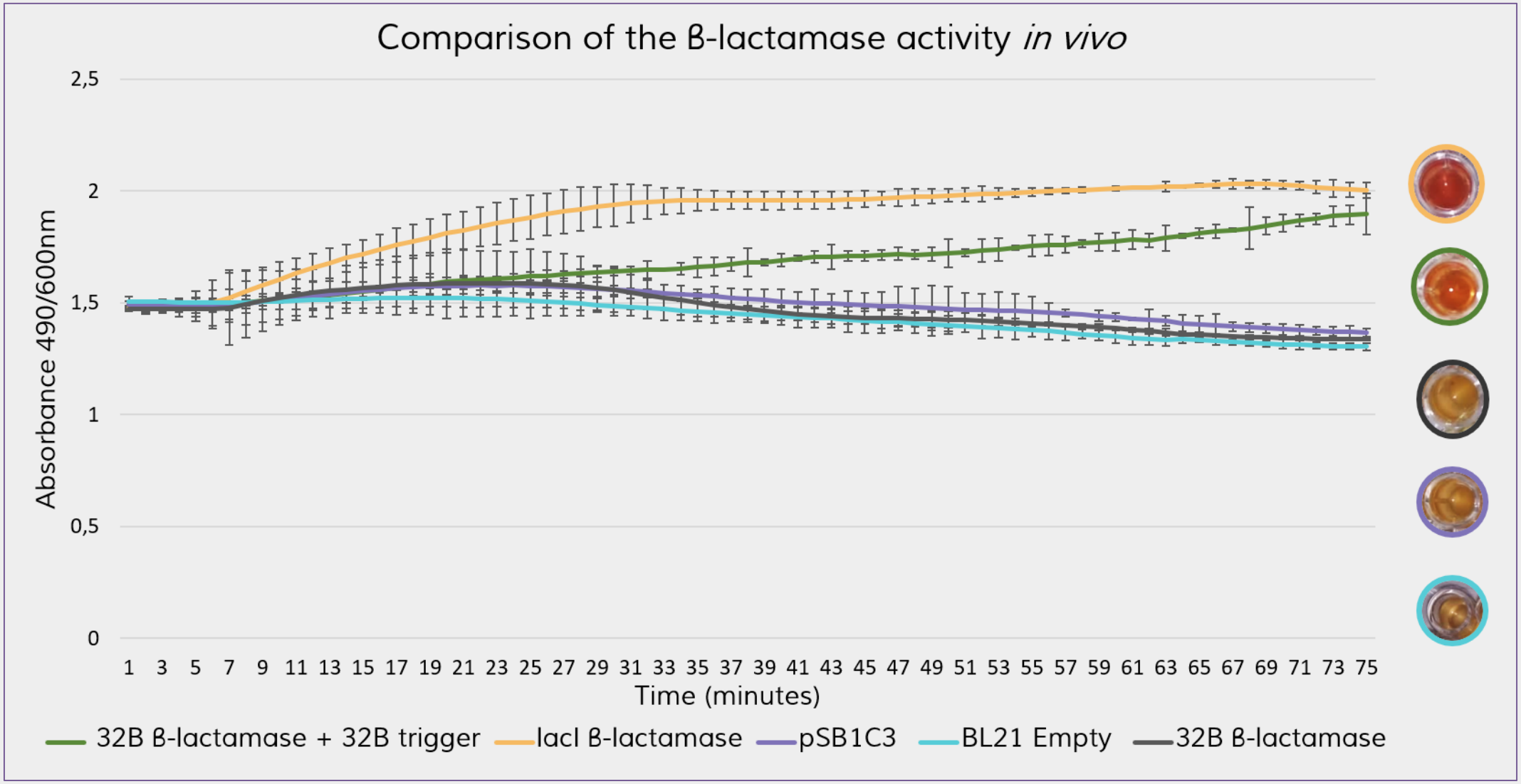
Characterization

BBa_I757010



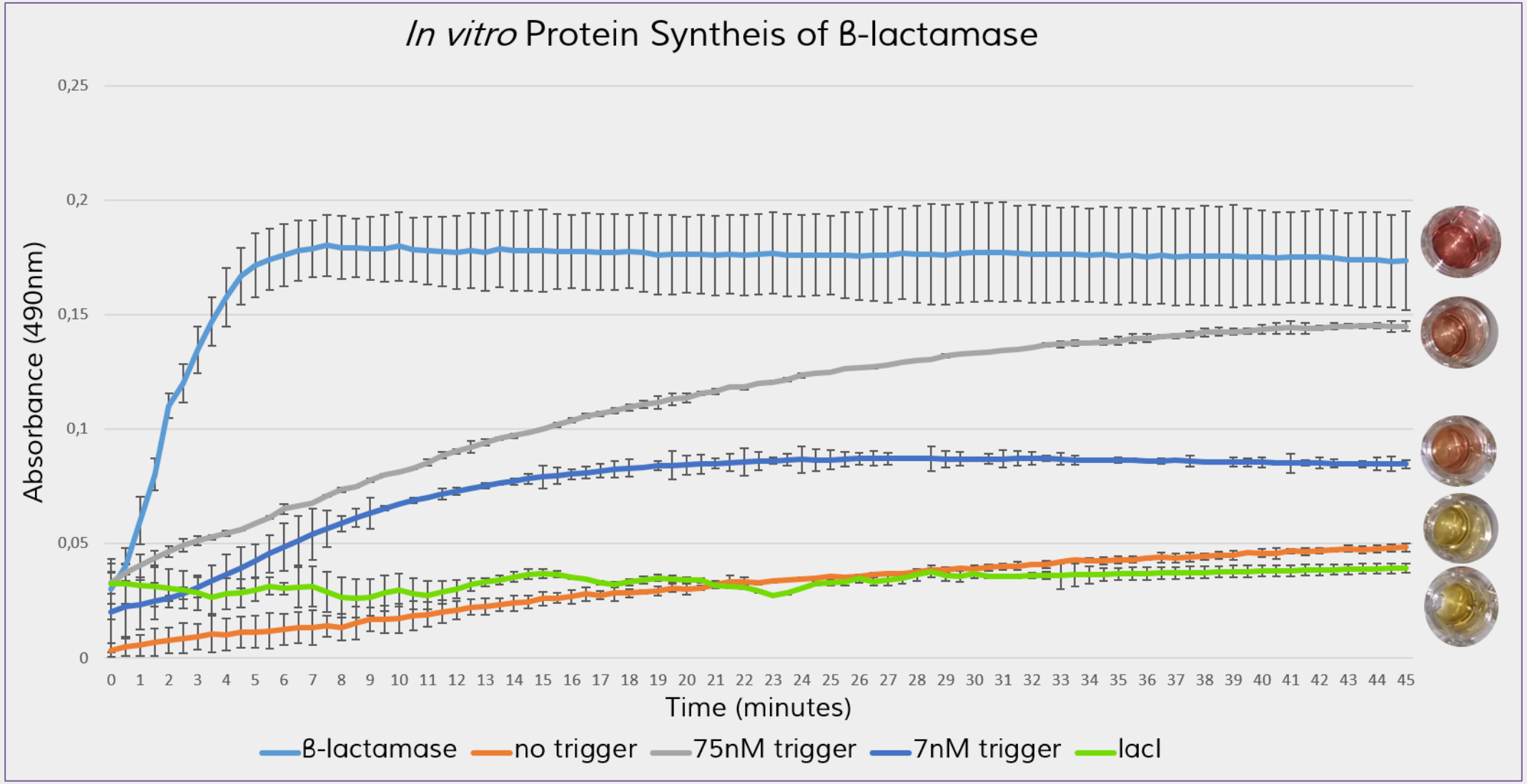
Improvement
BBa_K1189007

In vivo



Improvement
BBa_K1189007

In vitro



Existing Solutions

	Description	Benefits	Limitations
Smear Microscopy	Microscopic examination of smears prepared from sputum or other biological specimens to detect acid fast bacilli after staining with acid-containing.	-Cost-effective -Easy to perform -Highly specific	-Low sensitivity (20 – 80%) -Results are seldom on the same day.
XPERT/RIF	A real-time quantitative PCR assay for *Mycobacterium tuberculosis* -complex DNA. It amplifies part of the rpoB gene that contains mutations that cause rifampicin resistance (a critical first-line drug).	-High sensitivity & specificity (89% and 99%, respectively) -Detection of TB and resistance, simultaneously -Time efficient (results <2h) -Universal Gene Xpert platform for diagnosing other diseases.	-Need for uninterrupted power -Expensive instrumentation -Predominantly implemented in centralized laboratories -Limited affordability -Need for annual recalibration of the instrument -Requires trained personnel -Inability to distinguish between live and dead bacilli. -Sensitive to high temperatures

Existing Solutions

Lypoarabinomannan (LAM) Test	A lateral flow assay for Lypoarabinomannan (a component of the mycobacterial cell wall) detection in urine of patients with TB.	-Result in 25 minutes -Cost-effective (<3 USD) -Urine based test	-Low sensitivity (56%) & specificity -The test may be used to assist the diagnosis of TB in HIV positive patients and TB presumptive patients who have a CD4 count less or equal to 100 cells/L (WHO policy guidance 2015)
Tuberculin Skin Test (TST)	Immune response - based screening method performed by an intradermal infection of a purified protein derivative from MTB, tuberculin, into the skin of the forearm.	-Cost effective -Diagnosis of latent TB	-Recent Bacillus Calmette Guırin (BCG) vaccination history limits the specificity of TST -Positive in exposure to nontuberculous mycobacteria (NTM) -Dependent on the immune status of the patient -Requires two visits at a health care provider within 48 to 72 hours. -Cannot separate latent infection from active disease
Interferon Gamma Release Assays (IGRAs)	Measurement of a person's immune reactivity to *M. tuberculosis*. White blood cells from most persons that have been infected with M. *tuberculosis* will release interferon - gamma (IFN-g) when mixed with antigens derived from *M. tuberculosis*.	-Less cross-reactivity with BCG than with TST -Diagnosis of latent TB -Available results within 24 hours	-Complex infrastructure -Need of highly skilled staff -Cannot separate latent infection from active disease. -Blood samples must be processed within 8-30 hours after collection, while white blood cells are still viable.

Medal Criteria

✔ Register for iGEM, have a great iGEM season, and attend the Giant Jamboree.
✔ Competition Deliverables
-Team Wiki
-Team Poster
-Team Presentation
-Judging Form
-Project Attribution
-Safety Forms
-Registry Part Pages
-Project Inspiration
✔ Attributions
✔ Project Inspiration and Description
✔ Characterization/Contribution: we have successfully added quantitative experimental characterization data for the ß-lactamase coding sequence BBa_I757010, under the control of different promoters from the Anderson family (BBa_J23100, BBa_J23105, BBa_J23106 and BBa_J23119).

✔ Validated part: we have successfully created a variety of new BioBrick Parts of our own design that are related to our project and work as expected. Our validated parts are BBa_K2973011 , BBa_K2973009 and BBa_K2973006.
✔ Collaborations
✔ Human Practices: we have created the SynArt events, interactive games for students and conducted several speeches to academic and non-academic events. Taking education in a deeper level, we introduced science to groups with limited access to education; refugee children and prisoners. .

✔ Integrated Human Practices: we contacted various stakeholders and implemented their opinion into our project.
✔ Improve a Previous Part: we have successfully created a new BioBrick Part that has a functional improvement of an existing BioBrick Part. The part we improved is BBa_K1189007 by altering the regulatory system upstream the coding sequence and make it functional *in vitro*. The new Biobrick Part is BBa_K2973007.
✔ Model Your Project
✔ Demonstration of your work

Past iGEM TB projects

Team iGEM	Drawbacks	Advantages of ODYSSEE	Advantages of the other projects
Paris Bettencourt 2013 (Uses CRISPR/Cas9 as detection method)	Uses sputum as a sample: • Many people are unable to produce sputum (especially children). • It's difficult to process • Doesn't include an amplification method. So, the sensitivity of the test decreases. **Biosafety warning:** Uses alive mycobacteria for the detection method	Uses urine as a sample: • Non invasive method • Easily accessible sample Involves RPA, a very sensitive and fast amplification method. Urine samples don't contain alive mycobacteria, but only DNA fragments of them.	Detects antibiotic resistance. A fast and cheap method. Result is visible with the naked eye

Past iGEM TB projects

Team iGEM	Drawbacks	Advantages of ODYSSEE	Advantages of the other projects
Pune 2017	Detection method is based on the cell cycle of the Mycobacterium Tuberculosis (48h). Not a fast method (under 48 hours). Doesn't specify which sample they are using. Biosafety warning: Uses alive mycobacteria for the detection method	Detection method is based on the presence of the IS6110 gene in urine samples. Detection method asts under 1 hour. Urine samples doesn't contain alive mycobacteria, but only DNA fragments	Result is visible with the naked eye. A cheap method.

Past iGEM TB projects

Team iGEM	Drawbacks	Advantages of ODYSSEE	Advantages of the other projects
SCSU New Haven 2016 (Uses VOCs as biomarker)	Their detection method wasn't tested. Not a reliable biomarker.		Result is visible with the naked eye.
Marseille 2019	Uses sputum as a sample: • Many people are unable to produce sputum(especially children). • It's difficult to process • Biosafety warning: Uses alive mycobacteria for the detection method	Uses urine as a sample: • Non invasive method • Easily accessible sample • Urine samples don't contain alive mycobacteria, but only DNA fragments of them.	

Cost Analysis

Components	Manufacturer	Cost/reaction (€)
RPA kit	TwistDx	2,60
Magnesium acetate	TwistDx	(included in RPA)
PURExpress	New England Biolabs	4,97
Nitrocefin	Cayman	0,30 (40µl)
Consumables		
Disposable pasteur pipette (3ml)	Anadrasis MED	0,019
Disposable microcentrifuge tubes 2 ml (x2)	Anadrasis MED	0,0122
DIY centrifuge	-	0,20
Eye drop tubes (x2)	Syndesmos	0,20
Syringe 0,5ml	Syndesmos	0,020