EUROPEAN iGEMJAMBOREE 2012 - VU UNIVERSITY AMSTERDAM (NL)

PROGRAM BOOK

EUROPEAN iGEM JAMBOREE 2012

5 - 6 - 7 OCTOBER
VU UNIVERSITY AMSTERDAM

ORGANIZING UNIVERSITIES

VU University Amsterdam
TU Delft
Wageningen UR
university of groningen
TU/e Technische Universiteit Eindhoven University of Technology
University of Amsterdam

Contents

Part I

Schedule

Schedule overview

Friday (5/10/2012): Meeting of Young Minds

Start	End	Name
19:30	22:00	Meeting of Young Minds

Saturday (6/10/2012): Presentations and poster session

A detailed program of the parallel sessions is available on page 5.

Start	End	Name
8:30	9:00	Reception
9:00	9:30	Opening ceremony
9:45	11:15	Parallel session 1
11:15	11:45	Coffee break
11:45	13:15	Parallel session 2
13:15	14:15	Lunch
14:15	15:45	Parallel session 3
16:00	17:00	Poster presentations
17:00	18:00	Poster presentations
19:00	1:00	Diner and Party at Lexion

Sunday (7/10/2012): Award ceremony

Start	End	Name
8:30	9:00	Reception
9:00	9:15	Award ceremony opening
9:15	10:45	Finalist presentations
10:45	11:15	iGEM from above
11:15	12:30	Brunch
12:30	14:00	Award ceremony
14:00	15:30	Workshops (optional)

Saturday parallel team presentation sessions

Parallel session 1			9:45	11:15
Team presentation session 1.1	**02A00**			
Edinburgh		Foundational Advance	9:45	10:15
Marburg SYNMIKRO		Foundational Advance	10:15	10:45
Evry		Foundational Advance	10:45	11:15
Team presentation session 1.2	**04A00**			
Copenhagen		Environment	9:45	10:15
Paris Bettencourt		Environment	10:15	10:45
METU		Environment	10:45	11:15
Team presentation session 1.3	**06A00**			
Chalmers-Gothenburg		New Application	9:45	10:15
TU-Eindhoven		New Application	10:15	10:45
Paris-Saclay		New Application	10:45	11:15
Team presentation session 1.4	**08A00**			
Uppsala University		Health & Medicine	9:45	10:15
Fatih-Medical		Health & Medicine	10:15	10:45
ETH Zurich		Health & Medicine	10:45	11:15
Team presentation session 1.5	**10A00**			
Leicester		Energy or Food	9:45	10:15
Frankfurt		Energy or Food	10:15	10:45
Lyon-INSA		Energy or Food	10:45	11:15
Team presentation session 1.6	**12A00**			
Exeter		Manufacturing	9:45	10:15
Potsdam Bioware		Manufacturing	10:15	10:45
EPF-Lausanne		Manufacturing	10:45	11:15

Parallel session 2			11:45	13:15
Team presentation session 2.1	**02A00**			
Westminster		Health & Medicine	11:45	12:15
Goettingen		Health & Medicine	12:15	12:45
Slovenia		Health & Medicine	12:45	13:15
Team presentation session 2.2	**04A00**			
LMU-Munich		New Application	11:45	12:15
ULB-Brussels		New Application	12:15	12:45
Technion		New Application	12:45	13:15
Team presentation session 2.3	**06A00**			
Cambridge		Foundational Advance	11:45	12:15
Warsaw		Foundational Advance	12:15	12:45
Bordeaux		Foundational Advance	12:45	13:15

Team presentation session 2.4	**08A00**			
Groningen		Energy or Food	11:45	12:15
Valencia		Energy or Food	12:15	12:45
Trieste		Energy or Food	12:45	13:15
Team presentation session 2.5	**10A00**			
NTNU Trondheim		Manufacturing	11:45	12:15
Grenoble		Information Processing	12:15	12:45
TU-Delft		Information Processing	12:45	13:15
Team presentation session 2.6	**12A00**			
St Andrews		Environment	11:45	12:15
Tuebingen		Environment	12:15	12:45
Bielefeld-Germany		Environment	12:45	13:15

Parallel session 3			**14:15**	**15:45**
Team presentation session 3.1	**02A00**			
UNITN-Trento		New Application	14:15	14:45
NRP-UEA-Norwich		New Application	14:45	15:15
Valencia Biocampus		New Application	15:15	15:45
Team presentation session 3.2	**04A00**			
Dundee		Health & Medicine	14:15	14:45
Wageningen UR		Health & Medicine	14:45	15:15
SDU-Denmark		Health & Medicine	15:15	15:45
Team presentation session 3.3	**06A00**			
TU Darmstadt		Environment	14:15	14:45
University College London		Environment	14:45	15:15
UTBC-RDCongo		Environment	15:15	15:45
Team presentation session 3.4	**08A00**			
TU Munich		Foundational Advance	14:15	14:45
Team presentation session 3.5	**10A00**			
Bonn		Energy or Food	14:15	14:45
Freiburg		Energy or Food	14:45	15:15
Amsterdam		Energy or Food	15:15	15:45

Part II

Jamboree handbook (short)

Questions, information, and emergency situations

Registration desk	+31-20-5985793	(lost & found, questions)
Aljoscha Wahl	+31-657-999887	(chair)
Jeannet Wijker	+31-644-416163	(posters, practice and presentation rooms)
Mark van Passel	+31-50-36 32093	(judging)

Emergency situations: medical, fire, police, etc.

If there is an emergency (medical emergency, fire, police, etc.) please contact VU campus emergencies numbers.

- From a campus phone: **22222**
- From a cell phone, pay phone, or off-campus: **112**

iGEMEurope on social media

You want to share thoughts, ideas or special findings during the Jamboree? Do not hesitate to post on our facebook page 'iGEM Regional Jamboree'.

Follow us on twitter @iGEM and @iGEMeurope throughout the Jamboree!. We'll be tweeting news, updates, and further information. You can also twitter questions during the event. The official hashtag for the Regional Jamboree is **#iGEM2012rj**. Also during the Meeting of Young Minds you can participate in the discussions via social media.

Location of iGEM activities (VU Campus)

All iGEM Jamboree activities take place in the main building at the VU Campus, except the diner and party on Saturday, which will take place at Lexion (bus transfer, see page 11).

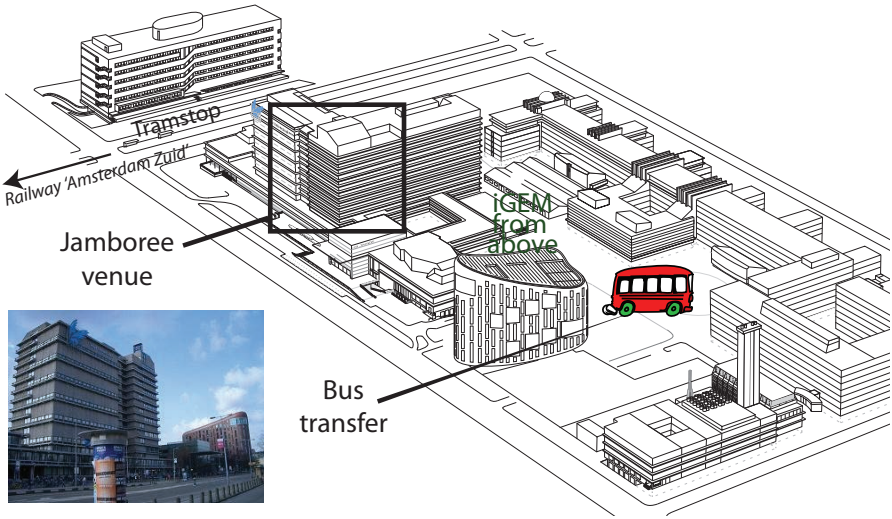

Figure 1: VU Campus and iGEM locations

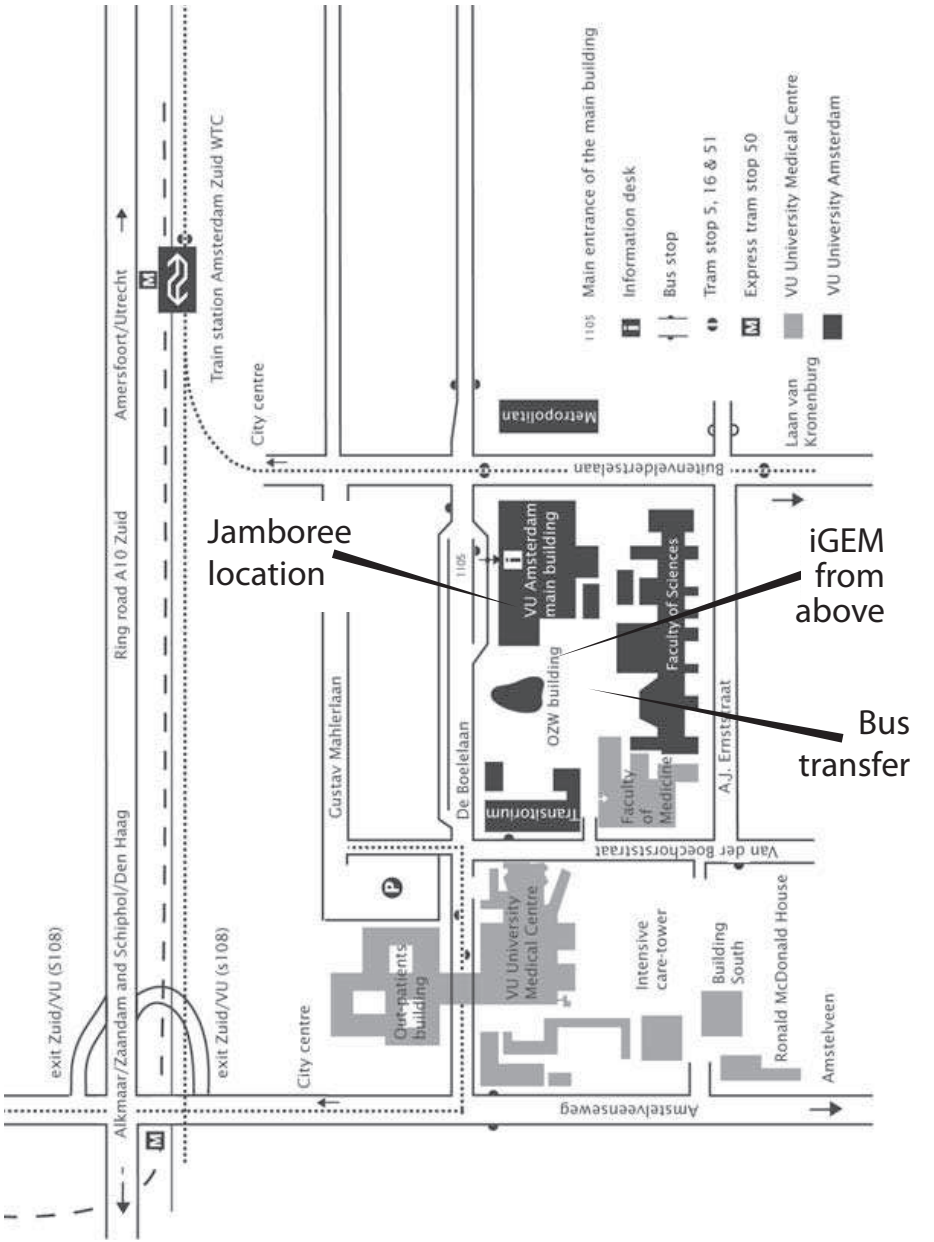

Figure 2: Area of the VU Campus

Poster session

A or **B**? The session is divided in two sessions to facilitate team interaction. During the assigned session make sure to be present at your poster to discuss your project with judges and other teams! During the other session, feel free to visit the posters of the other teams.

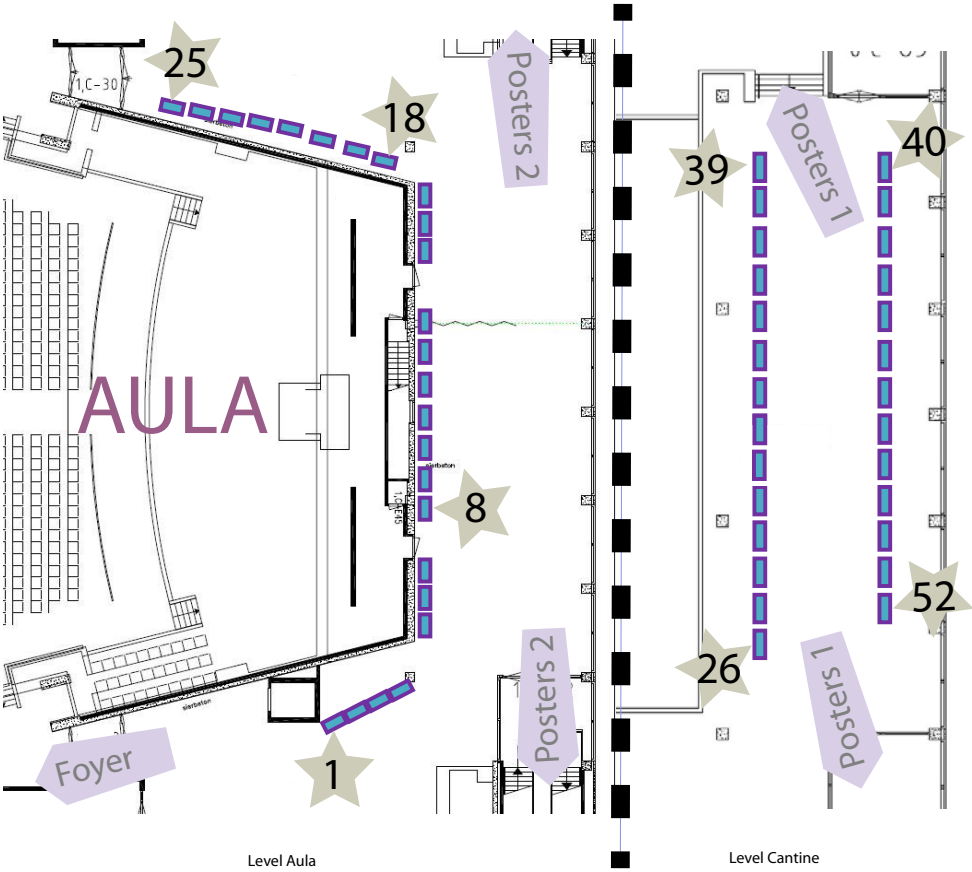

Figure 3: Poster area locations

Saturday night diner and party

On Saturday night after the poster reception, we will be hosting the iGEM Europe Jamboree Diner and Party at Lexion from 19:00 h to 01:00 h. At 18:00 h buses will bring you from the parking site at VU-campus to the social event (follow balloons and volunteers).
Note: You must have your iGEM name badge in order to gain access to the social event.
We highly encourage all iGEM participants to attend. Relax and have fun! At the end of the party the shuttle bus service will bring you back to your hotels. There will also be a shuttle service to the hotels during the party.
A shuttle service will be driving all night between the party location to the following drop-off places:

- VU Campus, Boelelaan 1105
- Bastion Hotel Amsterdam/Centrum Zuid, Hendrikje Stoffelstraat 60
- Bastion Hotel Amsterdam/Amstel, Verl. Van MarwijkKooystraat 30
- EMB Memphis Hotel, De Lairessestraat 87
- Ibis Hotel Amsterdam City Centre, Stationsplein 49
- Ramada Apollo Hotel Amsterdam Centre, Staalmeesterslaan 410

Note: The last buses back leave at 1.00 h!

Sunday workshops

After the award ceremony on Sunday, rooms will be available for teams to discuss and deliberate with each other about a variety of topics of their own choice. In this way you can exchange ideas before the World Championships Jamboree. Check the schedule for times, locations and topics. Don't hesitate to submit a topic and invite other teams to participate! The schedule of workshops can be found on the iGEM Europe wiki: `http://2012.igem.org/Regions/Europe/Workshops` and at the registration desk.

Amsterdam

Some handy facts

Transportation

The city of Amsterdam has a dense public transportation system based on bus, tram and metro connections.

Getting around in Amsterdam

Students can get around Amsterdam by public transport, or the very Dutch way: by using a rented (not stolen!) bike. Public transport and bikes are the main and quickest means of transport in Amsterdam – the own car needs a parking spot, which is expensive in Amsterdam.

By public transport Public transportation (tram, metro and bus) is one of the easiest ways to get around in Amsterdam. Public transport in Amsterdam is run by GVB. One of the GVB Tickets and Information desks is at the Stationsplein opposite of the Central Station. Several types of tickets are available. We recommend, a 2 day ticket, giving unlimited access to public transport (tram, metro and bus, but EXCLUDING the special night-buses) in Amsterdam, for €12.00. A GVB one-hour card costs €2.70.
Note: Use the disposable cards. The plastic anonymous cards, costs an additional €7.50 for the card
Are you travelling with others? Every passenger requires their own OV-chipkaart. Tickets can be purchased from vending machines or in the bus or tram. Prices and places to buy these tickets can be found on the GVB website. You can plan trips on the journey planner 9292.nl, or use the app (search for 9292).
Note: With this OV-chipkaart, you must check-in and check-out when boarding or disembarking from a tram, bus, or metro. Make sure you do not hold the card in front of the reader twice because you will not only be checking in but also checking out. If an inspector checks the tickets and you are not checked in you will be fined! Even when you transfer from one modality to another you need to check out. You will again check in when you use the next transport modality. You can check in and out at the smart card readers. The smart card readers are located at the doors of a bus or tram. Gates are used in metro stations.

By train Train tickets can be bought from the yellow & blue ticket machines. The machines accept payment by various means - all accept Dutch PIN chip cards, only some take euro coins. Note payment with euro notes is not always possible.
You can purchase a Single, Day Return or Weekend Return to your destination on the day of travel - in either first class or (standard) second class. A Weekend Return is similar to the Day Return and costs the same, but your return journey does not have to be on the same day as your outward journey. A Weekend Return is valid from 19.00 h Friday evening to 04.00 h Monday morning. With a normal train ticket you can just jump onboard any normal service (Intercity and Sprinter trains) and free seating in your class is in effect.
Note: Use the disposable cards. The plastic anonymous cards, costs an additional €7.50 for the card and €20 boarding rate.
You can plan your trip in advance on the website of the on the journeyplanner website 9292. For only train travel, use ns.nl

By bike Biking is the most flexible way of getting around in Amsterdam. Your hotel should be able to give you information about the nearest bike-rental shops.

By taxi Call Taxi: +31 20 7777777

VU University by public transport

VU University Amsterdam (De Boelelaan 1105, Amsterdam) is accessible by different means of transport. Please find maps to help you orient on page 8.

From *Amsterdam Central Station*

- **Metro-tram 51**, direction *Amstelveen Westwijk* (16 minutes). Get off at: **De Boelelaan / VU**
- **Tram 5**, direction *Amstelveen Binnenhof* (25 minutes). Get off at: **De Boelelaan / VU**
- **Tram 16** or **24**, *direction VUmc* (VU medical center). Get off at final stop: **VUmc**

From *Amsterdam Zuid* railway station

- It is a 10 min. walk to the VU University Main Building. To get your bearings correct: when you are on the railway platforms facing South you will see buildings with signs "Boekel de Neree" and "Baker & McKenzie", as well as a remarkable edgy black-and-grey office building called "The Rock" (see page 8). Determine where the West is, and walk all the way to the West end of platform, even past "The Rock". There is a well-hidden exit. Descend the stairs and turn left. After leaving the station through the swing doors turn right and cross the road and tram railways (watch out for traffic!). Across the street turn left (to the South). After a 5 minutes' walk along a little bushy area you will see the VU buildings.

By car The A-10 Amsterdam ring road can be reached from all directions. Follow the A-10 to the Zuid / Amstelveen exit S 108. Turn left at the end of the slip road onto Amstelveenseweg: after about three hundred yards (at the VU University hospital building) turn left again onto De Boelelaan. VU University Amsterdam can be reached via city routes S 108 and S 109.

Parking There is a limited amount of parking space around VU University in *De Boelelaan*, which has parking bays, and also in *Karel Lotsylaan*. There is paid parking (€3/h) on VU parking lot to the right of the Hospital Outpatient Clinic. There is even more parking space on the east side of *Buitenveldertselaan* at the junction with *Willem van Weldammelaan*, within 5 minutes walking distance of the VU. A number of parking places for the handicapped are reserved in front of the VU Main Building and within its grounds. Parking at the inner campus area of the VU is expensive: €3 per hour, also during the weekend! Nevertheless, on Fridays after 19:00 h and on Saturdays and Sundays parking is free in immediate vicinity South and East of the VU campus. But to avoid nasty surprises, be sure to check the signs and parking ticket machines!

Part III

Team specific: Tracks, Presentations, Posters and Abstracts

Overview

Team	Track	Poster	Start	Room
Amsterdam	Energy or Food	A 37	15:15	10A00
Bielefeld-Germany	Environment	B 28	12:45	12A00
Bonn	Energy or Food	A 29	14:15	10A00
Bordeaux	Foundational Advance	A 17	12:45	06A00
Cambridge	Foundational Advance	A 41	11:45	06A00
Chalmers-Gothenburg	New Application	A 01	9:45	06A00
Copenhagen	Environment	A 15	9:45	04A00
Dundee	Health & Medicine	B12	14:15	04A00
Edinburgh	Foundational Advance	A 07	9:45	02A00
EPF-Lausanne	Manufacturing	B 08	10:45	12A00
ETH Zurich	Health & Medicine	A 27	10:45	08A00
Evry	Foundational Advance	B 14	10:45	02A00
Exeter	Manufacturing	A 09	9:45	12A00
Fatih-Medical	Health & Medicine	A 47	10:15	08A00
Frankfurt	Energy or Food	B 22	10:15	10A00
Freiburg	Energy or Food	B 48	14:45	10A00
Goettingen	Health & Medicine	B 40	12:15	02A00
Grenoble	Information Processing	A 05	12:15	10A00
Groningen	Energy or Food	A 21	11:45	08A00
Leicester	Energy or Food	A 25	9:45	10A00
LMU-Munich	New Application	B 34	11:45	04A00
Lyon-INSA	Energy or Food	B 06	10:45	10A00
Marburg SYNMIKRO	Foundational Advance	A 35	10:15	02A00
METU	Environment	A 33	10:45	04A00
NRP-UEA-Norwich	New Application	B 20	14:45	02A00
NTNU Trondheim	Manufacturing	A 11	11:45	10A00
Paris Bettencourt	Environment	B 44	10:15	04A00
Paris-Saclay	New Application	A 31	10:45	06A00
Potsdam Bioware	Manufacturing	A 39	10:15	12A00
SDU-Denmark	Health & Medicine	B 10	15:15	04A00
Slovenia	Health & Medicine	B 16	12:45	02A00
St Andrews	Environment	B 04	11:45	12A00
Technion	New Application	B 18	12:45	04A00
Trieste	Energy or Food	B 02	12:45	08A00
TU Darmstadt	Environment	B 38	14:15	06A00
TU Munich	Foundational Advance	B 36	14:15	08A00
TU-Delft	Information Processing	A 23	12:45	10A00
TU-Eindhoven	New Application	A 13	10:15	06A00
Tuebingen	Environment	B 42	12:15	12A00
ULB-Brussels	New Application	B 32	12:15	04A00
UNITN-Trento	New Application	B 26	14:15	02A00
University College London	Environment	A 19	14:45	06A00
Uppsala University	Health & Medicine	A 03	9:45	08A00
UTBC-RDCongo	Environment	B 46	15:15	06A00
Valencia	Energy or Food	A 45	12:15	08A00

Team	Track	Poster	Start	Room
Valencia Biocampus	New Application	B 24	15:15	02A00
Wageningen UR	Health & Medicine	B 30	14:45	04A00
Warsaw	Foundational Advance	A 43	12:15	06A00
Westminster	Health & Medicine	A 49	11:45	02A00

Abstracts

Amsterdam

Cellular Logbook - A methylation-based reporter system

Track: **Energy or Food** Presentation: **Room 10A00, 15:15h** Poster: **A 37**

Multi-sensing genetic devices offer great future perspectives for biotechnology, environmental monitoring and medical diagnostics. In light of this we have created an innovative DNA-methylation based reporter system in *E. coli*, named Cellular Logbook, that has the potential of simultaneously reporting on significantly more signals than current fluorescence-based systems (eg. GFP). The Cellular Logbook can be used to detect and store the presence of any compound linked to a transcriptional regulator. This system allows for offline monitoring by functioning as a memory module. Assessment of the memory status is performed by digesting with restriction endonucleases followed by gel electrophoresis. Furthermore, the Cellular Logbook is able to infer the time of signal-onset or signal-intensity using the natural dilution of the registered signal's due to cell division. In short our exciting new memory module could potentially be utilized as a platform for many groundbreaking technologies.

Bielefeld-Germany

TOXIC COMPOUNDS IN NATURAL WATER - A CASE FOR LACCASE

Track: **Environment** Presentation: **Room 12A00, 12:45h** Poster: **B 28**

The accumulation of endocrine disruptors and toxic substances in wastewater has serious consequences for aquatic life and may lead to severe damages in humans. Especially the use of synthetic estrogen in birth control pills results in increasing the concentrations of this disruptor in wastewater. Therefore, 'iGEM Team Bielefeld' is developing a biological filter using immobilized laccases, enzymes able to radicalize and break down a broad range of aromatic substances. For the production of laccases from different bacteria, fungi and plants, two expression systems are used: '*Escherichia coli*' and the yeast '*Pichia pastoris*'. Immobilization is carried out either by using cpc-silica beads or by fusing the enzymes to cellulose binding domains. The concept could be extended to other toxic pollutants in drinking and wastewater, as well as to industrial applications in paper and textile industries or even for bioremediation of contaminated soil.

Bonn

All You Need is LOV!

Track: **Energy or Food** Presentation: **Room 10A00, 14:15h** Poster: **A 29**

Fusion protein design has always been time- and design-intensive, to say the least. We are developing and characterizing a fusion construct containing a light sensitive domain, providing easy coupling and light activation of proteins of interest to investigators, thus developing a protein-level light-induced knockout. Using the LOV (Light, Oxygen, Voltage) domain commonly found in plants, where it enables light-directed growth, we are establishing guidelines for coupling proteins of interest to the LOV domain, which allows control of protein activity through blue wavelength light. Designing our reversible knockout at the protein level allows quick response times (2.2 microseconds activation time, 85 seconds deactivation time). A device of that kind could be of great importance as a tool for disinfection on a laboratory scale or mutant selection via blue light. Further potential applications of our LOV fusion system include bioreactor regulation or site-specific drug activation.

Bordeaux

A bacterial eyespot

Track: **Foundational Advance** Presentation: **Room 06A00, 12:45h** Poster: **A 17**

This project aims at creating a regulatory system in the bacteria *Escherichia coli*. Our main goal is to engineer a single strain of bacteria able produce concentric patterns on the dishes. The challenge is to model a regulatory mechanism which mimics both cell differentiation and cell-to-cell communication observed in eukaryotes. We chose to create four operons (a total of 21 assemblies): three to allow the communication and expression of a visible phenotype, the fourth containing the genes needed for signal transduction. Each of the three first operons will respond to a specific quorum-sensing system (QSS) and trigger another QSS resulting in a chain reaction communicating a unique signal to all bacteria nearby. We also developed our model in silico to run simulation and test parameters that influence pattern propagation on a petri dish.

Cambridge

Parts for a reliable and field ready biosensing platform

Track: **Foundational Advance** Presentation: **Room 06A00, 11:45h** Poster: **A 41**

Implementation of biosensors in real world situations has been made difficult by the unpredictable and non-quantified outputs of existing solutions, as well as a lack of appropriate storage, distribution and utilization systems. This leaves a large gap between a simple, functional sensing mechanism and a fully realised product that can be used in the field. We aim to bridge this gap at all points by developing a standardised ratiometric luciferase output in a Bacillus chassis. This output can be linked up with prototyped instrumentation and software for obtaining reliable quantified results. Additionally, we have reduced the specialized requirements for the storage and distribution of our bacteria by using Bacillus'

sporulation system. To improve the performance of our biosensing platform we have genetically modified Bacillus' germination speed. Lastly, we demonstrated the robustness of our system by testing it with a new fluoride riboswitch, providing the opportunity to tackle real life problems.

Chalmers-Gothenburg

Biodetection of hCG hormone - Development of a biodegradable pregnancy test kit

Track: **New Application** Presentation: **Room 06A00, 9:45h** Poster: **A 01**

The goal of this project was to construct a biosensor for the hCG hormone consisting of *S. cerevisiae*. The human luteinizing hormone receptor (LH/CG), a GPCR with high affinity for hCG, was therefore expressed in yeast. The yeast strain used contains a yeast/human chimeric G945;-subunit, enabling coupling of the LH/CG-receptor with the pheromone pathway in yeast. Binding of hCG should consequently result in activation of the pathway. The genes tnaA and fmo, encoding tryptophanase and flavin-containing monooxygenase respectively, were introduced into the yeast strain. These enzymes catalyze the conversion of tryptophan to indigo. tnaA was set under the control of the pheromone induced FIG1 promoter and fmo was expressed constitutively. Hence, detection of hCG should result in the production of bio-indigo, the output signal of the biosensor. In order to ensure hCG to pass the cell wall, the gene CWP2, encoding a cell wall mannoprotein, was deleted.

Copenhagen

CyanoDelux

Track: **Environment** Presentation: **Room 04A00, 9:45h** Poster: **A 15**

Our overall objective is to create cyanobacteria that glow exclusively in darkness. To accomplish this, we will use a native promoter (IrtA) that normally functions as a light-regulated promoter in cyanobacteria. We will insert it into a plasmid together with the luxCDABE cassette. The cassette contains the luciferase enzyme and enzymes necessary for regeneration of its substrates. The final goal is to make cyanobacteria (*Synechococcus elongatus* PCC 7002) glow because cyanobacteria perform photosynthesis and therefore do not need supplied nutrients. First, the experiment is carried out in *E. coli* and afterwards the plasmid is transferred to the cyanobacteria. Both of the systems will subsequently be thoroughly analyzed to determine important characteristics of the system including kinetics and efficiency of the expression levels. To achieve this quantification we will collaborate with a fellow Physics student at University of Copenhagen.

Dundee

Six, Lyse and Obliterate: a synthetic silver bullet against healthcare acquired infection.

Track: **Health & Medicine** Presentation: **Room 04A00, 14:15h** Poster: **B12**

Hospital acquired infections are a global problem. One example is *Clostridium difficile*, a bacterial pathogen that infects patients undergoing prolonged antibiotic treatment and results in pseudomembranous colitis, a potentially fatal gut infection. This project aimed to design a synthetic bacterium that would respond to *C. difficile* infection and kill the pathogen in situ. *Escherichia coli* was engineered to secrete an endolysin from a bacteriophage that would specifically attack the *C. difficile* cell wall. The endolysin was fused to the extracellular components of an engineered Type VI Secretion System from Salmonella, which itself comprised 13 different proteins. In addition, a synthetic 'inflammation biosensor' was developed, based on a two-component system from Salmonella, with the aim of restricting endolysin secretion to the diseased colon only. Mathematical modelling was used to assist in the development of the laboratory work and to investigate potential therapeutic strategies beyond the scope of the experimental programme.

Edinburgh

Tools that make synthetic biology easier and safer - questioning legacy and friendliness

Track: **Foundational Advance** Presentation: **Room 02A00, 9:45h** Poster: **A 07**

Edinburgh's 2012 iGEM project focuses on developing tools that expand the range of synthetic biology applications. We are characterizing *Citrobacter freundii* as a chassis in order to investigate the potential of a new host organism as an alternative to *Escherichia coli* in synthetic biology. The team is also looking at novel selectable and counter-selectable markers as a substitute for antibiotic based systems which facilitate the spread of antibiotic resistance in the environment. We seek to implement the MtrCAB electron transfer system from Shewanella oneidensis into *E. coli*, and test the resulting electron output from the organisms using microbial fuel cells. We are constructing computer models of the electron transfer chain and of cell survival with non-antibiotic markers. This tools-based project responds directly to legislation and safety. We considered how iGEM gives us the freedom to pursue blue-sky research and whether our work is driven by preconceptions of public opinion.

EPF-Lausanne

SWITCH: Direct, Light-induced Gene Expression for Optimal Drug Production in Mammalian Cells

Track: **Manufacturing** Presentation: **Room 12A00, 10:45h** Poster: **B 08**

The fusion protein our team aims to characterize is a version of the LovTAP construct (submitted as a BioBrick by the 2009 EPFL iGEM team) adapted to mammalian gene regulation. It allows for tight regulation of conditional gene expression (started upon illumination with a blue light) through a photo-sensitive domain coupled to DNA-binding and activating domains. We are also developing and building a custom bioreactor setup to create the appropriate conditions for the LovTAP switch to work, and modeling the behavior of our system. Development of optogenetics has mainly been focused on bacteria but we are also comparing our project to another mammalian system, developed by Fussenegger et al. (Science Vol. 23, 2011), that uses a melanopsin switch to trigger endogenous calcium-driven

promoters. Light-induced gene expression eliminates the need for activating molecules in sensitive applications such as the production of therapeutic proteins in the pharmaceutical industry.

ETH Zurich

E.colipse - Who's your pABA: intelligent sun protection

Track: **Health & Medicine** Presentation: **Room 08A00, 10:45h** Poster: **A 27**

*E. coli*pse is an intelligent and adaptive sun radiation protection system which responds to UV exposure with the production of the protective agent pABA. To detect hazardous levels of sun radiation our system is based on UVR-8, a UV sensing protein from plants. In its dark state, this protein forms a homodimer that dissociates upon UV radiation. We fused UVR-8 with the DNA binding domain from TetR, which is unable to dimerize and to bind DNA in monomeric form. UV-exposure might force the TetR-UVR8 fusion dimer to split, release the DNA and enable transcription. Thus, TetR-UVR8 might act as a light-activated on-switch in bacteria. We plan to use this novel switch to start the production of para-aminobenzoic acid (pABA), a common ingredient of sunscreen, and - dependent on the intensity and duration of exposure as determined by our detailed in silico model - a colored pigment as a visible warning signal.

Evry

A synthetic hormonal system for the vertebrate chassis Xenopus tropicalis

Track: **Foundational Advance** Presentation: **Room 02A00, 10:45h** Poster: **B 14**

Building on a long-standing French fascination for frogs, we wanted to spread this enthusiasm to the world of synthetic biology by introducing a new, vertebrate chassis to the community: *Xenopus tropicalis*. This leap towards multicellular biological engineering required new tools, so we first developed a new set of frog compatible vectors, biobricked tissue specific promoters and a new technique to assemble them in a single shot. To benefit from tissue compartmentalisation, we created a synthetic, orthogonal hormonal system using the plant molecule auxin. We also investigated *E. coli*/*Xenopus interfacing*, effectively creating a synthetic ecosystem. We modelled our system at the organism scale, using a multi-level and multi-technique approach. Finally, working with whole animals during iGEM brought a load of difficult ethical questions regarding animal biotechnologies and experimentation. This led us to wonder: Are we a chassis?

Exeter

e-candi: Engineering the Fourth Polymer of Life

Track: **Manufacturing** Presentation: **Room 12A00, 9:45h** Poster: **A 09**

Polysaccharides have a spectacular range of properties and uses, from the structural and medicinal, to foods and glues. These properties stem from the relationships between the

chemical nature of the sugars, their arrangement within the polymer and the arrangement of the polymer itself. Scientists rely on chemical modification of polysaccharides or expensive and time-consuming production via synthetic chemistry to understand these relationships. This project, e-candi, asks if synthetic biology could generate designer polysaccharides. We created biobricks for the biosynthesis of useful polysaccharides in *Escherichia coli* and asked whether we could synthesise a novel polymer sequence in *E. coli* by targeting endogenous polysaccharide biosynthesis. We developed this work further through the generation of a GTase database with a user-friendly interface to aid polymer construction, and by investigating a GTase donor/acceptor characterization assay alongside mathematical modeling of our biosynthetic system in order to improve system understanding and performance.

Fatih-Medical

Cancel the Cancer

Track: **Health & Medicine** Presentation: **Room 08A00, 10:15h** Poster: **A 47**

Our project is mainly based on the early diagnosis of cancer. EpCAM (Epithelial cell adhesion molecule) is a pan-epithelial differentiation antigen overexpressed on the basolateral surface of most carcinomas and Circulating Tumor Cells (CTC); the cells which are released into blood in early phases of cancer. Our objective is to fix appropriate antibodies for EpCAM antigens to the *E. coli* cell wall so that we will be able to detect CTCs before the cancer precipitates its way to metastasis. For the next step, we plan to enhance the detection signal in our bacteria by the means of quorum sensing mechanism. Finally, to prevent the production of possible undesirable and detrimental genetically modified organisms (GMOs), we aim to induce self-destruction device in our *E. coli* via emission of light.

Frankfurt

Steviomyces - Itgonna be sweet

Track: **Energy or Food** Presentation: **Room 10A00, 10:15h** Poster: **B 22**

The Stevia plant produces several sweeteners known as Steviolglycosides which have only recently been admitted as a food additive in the European Union. However it has been used as a traditional food ingredient by Paraguayan natives, for example to sweeten mate tea. The iGEM Team Frankfurt wants to transfer the pathway of the plant into baker yeast (*Saccharomyces cerevisiae*) to make stevia production much cheaper. Furthermore microbial production of these sweetening compounds could also lower the environmental costs of Sweetener production. In addition to these advantages, it would be possible to selectively produce only the most flavorful compounds. Several of known problems with carbohydrate sweeteners like diabetes or caries could be overcome by the Steviolglycosides which are produced by *Stevia rebaudiana*. Another interesting perspective is the capability of Steviolglycosides to reduce the blood sugar value.

Freiburg

Let us tell you a fabulous TALE ...

Track: **Energy or Food** Presentation: **Room 10A00, 14:45h** Poster: **B 48**

Transactivator-Like Effectors (TALEs) are a brand-new technology that currently revolutionizes the way researchers manipulate DNA with exceptional site specificity. Originally derived from *Xanthomonas spp.*, this type of protein comprizes an effector domain and a modular DNA binding domain that can be rationally designed to bind to virtually any target sequence of DNA. Over the past two years, universal endonucleases (TALENs) and transcription factors have been tested in various organisms ranging from bacteria to humans. According to existing protocols, TALE assembly requires several weeks of work and substantial lab skills. In order to bring this technology within reach for iGEM students, we invented an extremely fast and easy TALE assembly strategy and developed a TALE platform with expression plasmids and new classes of TALEs. With our so called GATE assembly kit, future iGEM students will be able to precisely manipulate genomic loci easier and faster than anyone else in the world.

Goettingen

Homing coli: Engineering E. coli to become 'tracking dogs'

Track: **Health & Medicine** Presentation: **Room 02A00, 12:15h** Poster: **B 40**

The model organism *Escherichia coli* is naturally capable of sensing substances in its environment and consequently moves directionally towards these, a phenomenon known as chemotaxis. Here, we apply directed evolution to chemoreceptors by targeting five amino acid residues in the ligand binding site to enable *E. coli* to perceive novel substances. In order to investigate mobility and directed movement towards a substance, an effective mobility selection method using special 'swimming plates' is designed. Additionally, we attempt to improve *E. coli*'s swimming velocity by creating new parts derived from its own motility apparatus. Based on our selection system, we identify variants of chemoreceptors with new binding specificities in the mutant library. By these means, we aim to train the bacterium to detect new molecules such as tumor cell markers. Once having established *E. coli* as our 'tracking dogs', the possible applications in medicine but also to environmental issues are virtually countless.

Grenoble

sEnsiColi: A tunable and reliable ultra-sensitive detector

Track: **Information Processing** Presentation: **Room 10A00, 12:15h** Poster: **A 05**

Multi-resistant bacteria are a worldwide issue which in a very near future will have huge impacts on our societies and ways diagnosis and prevention will be performed. In this optic, the Grenoble iGEM team has built an ultra-sensitive pathogen detector. It consists of three interconnected modules: 1- Detection, 2- Amplification/ Communication and 3- Output. The detection module consists of a recombinant membrane receptor that, once activated, actuates an amplification loop. The amplification system contains a genetic feed

forward loop, which filters out false positive outputs. Once amplified and filtered, the signal is transmitted to neighboring bacteria via a diffusible molecule. In turn, the amplification loop is triggered which leads to the production of a measurable fluorescence output. The design of our network is easily adaptable to different input signals by using other receptor domains.

Groningen

The Food Warden. It's rotten and you know it!

Track: **Energy or Food** Presentation: **Room 08A00, 11:45h** Poster: **A 21**

Every year, one third of global food production -1.3 billion tons of food- is thrown away, partially due to the 'best before' dating system. iGEM Groningen 2012 seeks to provide an alternative method of assessing edibility: The Food Warden. It uses an engineered strain of *Bacillus subtilis* to detect and report volatiles in spoiling meat. The introduced genetic construct uses a promoter to trigger a pigment coding gene. This promoter, identified by microarray analysis, is significantly up-regulated in the presence of volatiles from spoiled meat. The activity of the promoter regulates the expression of the pigment reporter and will be visible to the naked eye. For safe usage of the system, spores of our engineered strain are placed into one half of a semi-permeable capsule, the second containing a calibrated amount of nutrients. Breaking the barrier between the two compartments allows germination and growth, thereby activating the spoiling meat sensor.

Leicester

A Synthetic Biology Solution To Polystyrene Degradation.

Track: **Energy or Food** Presentation: **Room 10A00, 9:45h** Poster: **A 25**

Objective - Naturally occurring organisms using polystyrene as their sole source of carbon have been recently identified, by analysing the occurrence of polystyrene breakdown products. However these metabolites accumulate very slowly, explaining why polystyrene is so persistent in the environment. Polystyrene can currently be recycled, but due to the low density of the majority of polystyrene products it is economically unfavourable, due to the high energy demands. If inexpensive biological degradation can be achieved this would assist recycling, but we also hope to use products of this reaction to make useful organic chemicals. Aim - To construct BioBricks from the genes encoding enzymes involved in this pathway and manipulate their expression and properties to maximise the rate of polystyrene degradation. Hypothesis - genes encoding the enzymes of the polystyrene breakdown pathway can be isolated and expressed in a host microorganism and the rate of the process increased by genetic manipulation.

LMU-Munich

Beadzillus: Fundamental BioBricks for Bacillus subtilis and spores as a platform for protein display

Track: **New Application** Presentation: **Room 04A00, 11:45h** Poster: **B 34**

We chose to work with *Bacillus subtilis* to set new horizons and offer tools for this model organism to the *Escherichia coli*-dominated world of iGEM. Therefore, we created a BacillusBioBrickBox (BBBB) composed of reporter genes, defined promoters, as well as reporter, expression, and empty vectors in BioBrick standard. B. subtilis naturally produces stress resistant endospores which can germinate in response to suitable environmental conditions. To highlight this unique feature using the BBBB, we developed Sporobeads. These are spores displaying fusion proteins on their surface. As a proof of principle, we fused GFP to the outermost layer. Expanding this idea, we designed a Sporovector to easily create any Sporobead imaginable. Because the Sporobeads must be biologically safe and stable vehicles, we prevented germination by knocking out involved genes and developed a Suicideswitch turned on in case of germination. With the project Beadzillus, our team demonstrates the powerful nature of B. subtilis.

Lyon-INSA

Biofilm Killer: long-term destruction of biofilms in an industrial context.

Track: **Energy or Food** Presentation: **Room 10A00, 10:45h** Poster: **B 06**

Biofilms are responsible for billions of dollars in production losses and treatment costs in the industry every year. Biofilm-related problems are major concerns in the food industry where it can cause food spoilage or poisoning, in health industry because of pathogens' persistence and dispersal, or in the oil and water industry where it causes corrosion. Assuming that the environment is already over-saturated with harmful chemicals such as biocides, whose long term health effects remains to be elucidated, there is a great need for innovating solutions to reduce detrimental biofilm effects. To reduce the use of biocides, the INSA-Lyon iGEM team aims to engineer a bacterial 'torpedo' capable to infiltrate and destroy biofilms formed on industrial equipments, pipes or reservoirs. Industrial surfaces will then be protected from further deleterious contamination by either a surfactant coating, or the establishment of a protective biofilm produced by the torpedo bacteria.

Marburg SYNMIKRO

'The Recombinator': an intelligent Genetically Engineered Slot Machine (iGESM)

Track: **Foundational Advance** Presentation: **Room 02A00, 10:15h** Poster: **A 35**

The vertebrate immune system produces billions of different antibodies. This diversity is generated by random VDJ-recombination of a limited number of antibody subfragments. This inspired us to construct an automatic recombination system in *E. coli* that generates large numbers of novel proteins by combinatorial fusion of functional domains. The site-specific DNA recombinase Gin of bacteriophage Mu depends on the presence of a DNA enhancer element for efficient recombination. This allowed us to construct a system, called 'The Recombinator', which automatically shuts down after successful recombination. We visualized the randomizing function of our genetically engineered slot machine by combining colors with cellular localization domains. By scaling up the number of recombination modules and functional domains our system will be able to generate a multitude of new

proteins. We envision that 'The Recombinator' will serve as a tool to create novel enzymatic activities for innovative drug design, environmental detoxification and metabolic engineering.

METU

eCO Filter

Track: **Environment** Presentation: **Room 04A00, 10:45h** Poster: **A 33**

Carbon monoxide (CO) poisoning is one of the most harmful types of air poisoning around the world.CO gas is mostly released from the internal combustion of engines as well as the use of fuels such as wood and coal.Since CO is highly produced in urban areas,it presents a big danger for any living organism.The aim of our project is to convert CO into CO2 biologically,which then can be converted into oxygen with photosynthesis by photoautotrophic organisms.In order to achieve this,we plan to construct a biofilm containing the enzyme Carbon Monoxide Dehydrogenase (CODH).With the production of this biofilm,it may be possible to obtain a biological filter that can fix the ratio of CO and CO2 present in the environment.We also try to integrate a kill switch,previously developed by Berkeley,to our system for safer use of our biofilm as well as a cell limiter for better characterization of the biofilm activity.

NRP-UEA-Norwich

A future using quantitative computing and its applications using a dual promoter.

Track: **New Application** Presentation: **Room 02A00, 14:45h** Poster: **B 20**

Imagine a world in which all sectors of industry use synthetic biology to meet specific needs. The NRP-UEA team have developed novel biobricks, which provide a foundation for a system with this level of complexity. The project began with a simple idea with widespread applications: the detection of exogenous nitric oxide (NO). However it soon became clear the detection of highly reactive NO was challenging, and this was addressed in two main ways. A bacterial promoter, PyeaR, was fused to its mammalian counterpart, CArG. The functionality of this flexible dual promoter was determined in both mammalian and bacterial chassis. Yet it was determined that further specificity was still needed, leading to the comparator circuit, that subtracts the expression of one promoter from that of another, allowing for signal integration and quantitative computing. This system thus allows for the detection of any chemical, providing the promoters have overlapping specificity.

NTNU Trondheim

Bacterial Anti Cancer Kamikaze

Track: **Manufacturing** Presentation: **Room 10A00, 11:45h** Poster: **A 11**

One of the biggest problems with the cancer treatment used today is that normal chemotherapy is harming healthy cells in addition to cancer cells. Our approach for solving this problem has been to develop a genetic circuit that makes *E. coli* cells able to release toxic molecules

only when in presence of cancer cells. As cancer cells grow faster than healthy cells, they also consume more oxygen and release more lactate than a healthy cell would do, so to make the *E. coli* cells recognize cancer cells we have made a system where the input signals are high lactate concentration and low oxygen concentration. When these criteria are met, the *E. coli* cells will undergo lysis, and release the toxin colicin, which our cells are producing constitutively. With our project, we want to show that one of the biggest challenges in medicine can be solved by synthetic biology.

Paris Bettencourt

bWARE

Track: **Environment** Presentation: **Room 04A00, 10:15h** Poster: **B 44**

Many synthetic biology projects propose the application of Genetically Engineered Organisms (GEOs) in natural environments. However, issues of biosafety and ethics constrain the use of GEOs outside the lab. A primary concern is the Horizontal Gene Transfer (HGT) of synthetic genes to natural populations. Strategies developed to address this problem provide varying levels of containment, however, the substantial elimination of HGT remains difficult or perhaps impossible. We have developed a new containment system to expand the range of environments where GEOs can be used safely. To do so, we rely on three levels of containment: physical containment with alginate capsules, semantic containment using an amber suppressor system, and an improved killswitch featuring delayed population-level suicide through complete genome degradation. We aim to raise the issue of biosafety by engaging the general public and scientific community through debate, and to advocate the discerning use of biosafety circuits in future iGEM projects.

Paris-Saclay

GEMOTE: a new tool to control gene expression by temperature

Track: **New Application** Presentation: **Room 06A00, 10:45h** Poster: **A 31**

We designed a system that allows controlling the expression of a gene or an operon over a specific temperature interval (between 32 and 42 degrees Celsius). This system consists of an RNA thermometer controlling the translation of a thermosensitive transcriptional repressor, which itself controls the expression of the targeted gene or operon. In our current construction, the crtEBI operon directing lycopene biosynthesis is used as a reporter, allowing us to check our system's performance. However, the possible applications of this system are extremely numerous. For example, controlling the expression of a toxin would allow creating a 'suicidal bacterium' that would bring on its own death outside the specified temperature range. This will help preventing its spread in the environment. And this is just one example... The only limit is our imagination !

Potsdam Bioware

Antibody Generation System - Maturation, Selection and Production in CHO Cells

Track: **Manufacturing** Presentation: **Room 12A00, 10:15h** Poster: **A 39**

Antibodies are of utmost importance for research and therapy but their generation is laborious and time consuming. We established a novel streamlined workflow for obtaining antibodies by incorporating all natural steps such as antibody maturation, selection and production in one genetic system implemented into a eukaryotic cell line. We stably transfect an antibody construct into CHO cells and mimic maturation by using the enzyme AID (activation-induced deaminase), which is known to induce somatic hypermutation. For selection, we are testing and deploying a versatile and continuous viral system as well as magnetic beads and cell sorting. Finally, a genetic switch enables the transition from surface expression to production of soluble antibodies. In addition, we pursue phage display with an antibody fragment to study mutation rate and evolution by AID in prokaryotes. Our system supersedes animal immunization, and the smooth process will increase the ready availability of antibodies in various formats.

SDU-Denmark

Novel approach in the fight against obesity: modulating gut microbiota by probiotic inulin producing bacteria

Track: **Health & Medicine** Presentation: **Room 04A00, 15:15h** Poster: **B 10**

Obesity is associated with a low-grade inflammatory response, which among other things, is triggered by bacterial plasma lipopolysaccharide (LPS). A high-energy diet, increases the amount of LPS-producing gut microbiota, and increased LPS levels has been observed in obese individuals. By inducing changes in the gut microbiota by prebiotics, like inulin, it is possible to decrease the plasma LPS level. This is associated with the stimulation of bifidobacterial growth. We have designed a novel approach to address this issue of plasma LPS, by probioticly induce changes in the gut flora by genetically modifying a bacteria to produce plant originated inulin. We cloned the two genes encoding sucrose:sucrose fructosyltransferase (SST) and fructose:fructose fructosyltransferase (FFT) from the Jerusalem artichoke into a *E. coli*, where it will produce inulin by using sucrose as an acceptor molecules. In the future this construct should be introduced by a probiotic lactobacillus, into the gut.

Slovenia

Switch-IT (Inducible therapeutics)

Track: **Health & Medicine** Presentation: **Room 02A00, 12:45h** Poster: **B 16**

Currently, biological drug-based therapies require periodic invasive application. Often, due to their systemic administration, adverse effects are observed. Furthermore, large quantities of these substances are needed because of their distribution throughout the body. This, coupled with expensive production and especially purification, imposes a great burden on health systems. We aim to develop a safe and cost-effective biological delivery system for biopharmaceuticals, which would increase the quality of patients' lives, because it would minimize the number of required procedures. This type of delivery system would increase patient compliance to the therapy while the local administration will reduce the side-effects associated with current treatments. We plan to design the mammalian cells-based delivery system to be regulated by the digital logic from the outside.

St Andrews

Mind-full of Resources: Alternative Omega-3 Production and Novel Meta Recovery Methods

Track: **Environment** Presentation: **Room 12A00, 11:45h** Poster: **B 04**

Omega-3 - known to prevent heart disease - is now causing governments to keep their finger on the pulse... of the fishing industry. Fish stocks are fast depleting and alternative sources of these essential fatty acids are urgently required. Our re-sourcing idea: the creation of an Omega-3 biosynthetic pathway in *E. coli*, using genes from a Cyanobacterium. Mass spectrometry analysis detected polyunsaturated fatty acids in cells expressing our desaturase enzymes; normal cells have none.
Additionally, in seeking modern resource management solutions, specifically designed short peptide chains on the C-terminus of a GST fusion protein were expressed allowing the binding of precious and toxic metals. Such metals are often deposited in the environment. Ultraviolet-visible spectroscopy was used to demonstrate binding to our novel proteins.
Finally, we modelled the impact our 'Fatty Acid Factory' could have on total fish biomass before investigating the effect the iGEM Competition has in Science and elsewhere.

Technion

Trojan Phage

Track: **New Application** Presentation: **Room 04A00, 12:45h** Poster: **B 18**

Viruses can be described as complex 3D structures capable of efficient infection of their target organism. Because of their highly specific infection ability, they can be used as vessels for 'smart' therapeutic strategies which rely on an agent that can effectively analyze the cellular environment and compute an appropriate response. To demonstrate the potential of a 'smart' strategy, we are developing a 'Trojan Horse' type of approach based on bactriophage-lambda.
Our project uses phage lambda and its target organism, *E. coli*, as a proof of concept for creating a system with predefined actions that demonstrates the described strategy. The design is based on a high specificity system which combines several different cell elements that will function as a type of logic AND gate. The phage will not harm the bacteria unless three independent conditions are met, activating the phage's lytic cycle and resulting in the bacteria's death; imitating a 'Trojan Horse'.

Trieste

The JOLLY JoCARE

Track: **Energy or Food** Presentation: **Room 08A00, 12:45h** Poster: **B 02**

Recent studies have evidenced that having a beneficial and healthy intestinal microflora is very important for human health. Our aim is to modify a bacteria normally found in human gut and create a safe, controllable and versatile molecular platform which can be used to produce a wide range of molecules leading to a beneficial probiotic. For this purpose we

have chosen the *E. coli* strain Nissle 1917 which has been used for many years as a probiotic. We designed a robust gene guard system regulated by a novel and easy to control inducible cumate switch that activates the production of a human antimicrobial peptide LL-37 that can kill the bacteria and also avoid horizontal transfer. The safe probiotic constructed here can be used to produce nutritious, preventive or therapeutic molecules. For example, we have used it to produce an antibody against the emerging virus, Norovirus.

TU Darmstadt

From trash to cash: The PET.erminators are breaking new grounds in biological recycling

Track: **Environment** Presentation: **Room 06A00, 14:15h** Poster: **B 38**

Polyethylene terephthalate (PET) has become the most widely manufactured synthetic polymer. With annual production exceeding 100 million tons (2010), it creates an issue of PET waste. In Western countries less than 70 % of PET production is recovered by recycling. Biological processes play no role so far, only expensive chemical processes are applicable yet. PET waste left to erosion in the environment creates nanoparticles which tend to accumulate toxic substances. This poses a growing environmental threat and a serious health risk. Thus, developing new methods for PET degradation has become an urgent issue. Team TUD designed a bacterial recycling system that uses PET waste as a resource for synthesis of new chemical compounds. The proposed solution pursues PET decomposition into its monomers, transportation into *E. coli* and leading via terephthalic acid (TPA) to a high-value end product. The latter's specification is determined by the inserted enzymes to build new metabolic pathways.

TU Munich

TUM-Brew: iGEM's first and finest SynBio Beer

Track: **Foundational Advance** Presentation: **Room 08A00, 14:15h** Poster: **B 36**

The TU Munich iGEM Team engineers "*Saccharomyces cerevisiae*", also known as baker's yeast, in order to lay the foundations for a new generation of functional foods with nutritionally valuable ingredients.
As an example, for iGEM's first "SynBio Beer" the compounds Xanthohumol (anticancerogenic), Limonene (limeflavor), Caffeine (stimulant) as well as the Thaumatin (protein sweetener) were chosen to demonstrate the spectrum of possibilities to complement traditional foods or beverages.
The metabolic pathways for these substances were converted to genetic BioBricks. Using the shuttle vector pYES2, which was adapted to the iGEM standard, transient transfection and expression in yeast were achieved. The gene products were subsequently characterized and their biosynthetic activities investigated.
Constitutive, alcohol-inducible and light-switchable promoter systems were developed, to individually regulate the expression of these gene cassettes. By combining these BioBricks our team has been able to brew iGEM's first and finest SynBio Beer.

TU-Delft

Snifferomyces

Track: **Information Processing** Presentation: **Room 10A00, 12:45h** Poster: **A 23**

The aim of this year's iGEM project will be the synthesis of an olfactory device for the purpose of characterization of volatile compound. Here, the aim is to introduce olfactory receptor gene fusions into *Saccharomyces cerevisiae* and linking these receptors to a transcription response. Aims:

- The diagnostics of the presence of tuberculosis bacteria in the lungs by sensing chemical compound methyl nicotinate by *S. cerevisiae*. For diagnostics, the response to these molecules is light, generated by the Lux proteins (visible blue light) or GFP (fluorescent green).
- Introducing receptors for sensing the presence of banana-smell (iso-amyl acetate). This is done to see whether communication between *S. cerevisiae* and *E. coli* is possible by this volatile intermediate.
- Supplying a toolkit which allows scientists to introduce olfactory receptors in yeast with minimal effort. Further we want to characterize the receptor parts submitted by the 2009 Hongkong university.

TU-Eindhoven

SOMY - LCD, the Super Optimized Modified Yeast' Light-emitting Cell Display

Track: **New Application** Presentation: **Room 06A00, 10:15h** Poster: **A 13**

Eindhoven, the city famous for its light bulbs, is the place where the roots of Dutch television lie. The iGEM team of the Eindhoven University of Technology developed an innovative electro-biological equipment which will be the replacement of your old television screen in the future! They proudly present to you the *SOMY - LCD*, the Super Optimized Modified Yeast' Light-emitting Cell Display. Its a multicolor display, in which genetically engineered yeast cells are electrically stimulated to induce a fluorescent light response and consequently function as pixels. Since calcium takes the leading part in this process, the yeast cells are engineered with fluorescent calcium sensors and extra voltage-gated calcium channels.

Tuebingen

Yeast based measurement system for endocrine disruptors in aquatic environments

Track: **Environment** Presentation: **Room 12A00, 12:15h** Poster: **B 42**

Lacking a genetically strict sex determination system, fish are very sensitive to hormonally active agents in water. The extensive use of fertilizers and the inability of sewage treatment

plants to break down drug waste lead to increasingly high concentrations of so-called endocrine disruptors in rivers. As a result, male fish have been found to be less fertile and even develop female sex tissue, so called ovotesties. Since fish spawn is constantly exposed to river waters, fish development is easily disturbed, and while the ratio of female fish increases, population numbers decrease. For sensing we use a membrane-bound receptor of Danio rerio. Activation will lead to bioluminescence which can be read out by photometric measurement.

ULB-Brussels

InteGreator

Track: **New Application** Presentation: **Room 04A00, 12:15h** Poster: **B 32**

In synthetic biology, one of the main issues scientists and engineers must tackle is biochemical pathways optimization. In this project, we are going to develop an exceptional natural tool that could be used to optimize bio-production pathways: the integron. Integrons are genetic platforms which contain (re)movable gene cassettes. These integrons are mostly known to carry resistances to antibiotics. They are flanked with recombination sites which allow gene shuffling inside the integron thanks to a specific enzyme: the integrase. With appropriate selective pressure, this shuffling should result in optimized production. As a proof of concept, we are going to produce two antibiotics: Microcin C7 and Microcin B17. Two bacteria possessing the integron containing the antibiotics production gene cassettes, the integrase and a low resistance to the opposite antibiotic will be put in competition. With the integrase, we could change the natural order of the genes in order to optimize production.

UNITN-Trento

Crust Away

Track: **New Application** Presentation: **Room 02A00, 14:15h** Poster: **B 26**

Statues and monuments all over the world are often covered in a disfiguring black crust caused by weather and pollution. Current methods to clean black crust are either too destructive or non-effective. The aim of our project is to develop a system to more gently restore statues and monuments. To achieve this goal, we engineered *E. coli* to eat the black crust. More specifically, we introduced an aerobic sulfate reducing pathway and a hydrogen sulfide producing pathway into *E. coli*. In this way, the sulfate component of the black crust is transformed into a gas, thereby degrading the offending substance without degrading the original material of the statue. In addition to our black crust project, we developed a ratiometric fluorescence platform to test transcriptional terminators and subsequently used the platform to compare the efficiencies of T7 and *E. coli* transcriptional terminators with T7 and *E. coli* RNA polymerases.

University College London

Plastic Republic - Bioremediation of Marine Microplastic Waste

Track: **Environment** Presentation: **Room 06A00, 14:45h** Poster: **A 19**

It is in the Great Pacific Garbage Patch that we are confronted with the real consequences of human plastic dependency: an immense mass of accumulating microplastic particles floating just beneath the surface of the North Pacific Ocean. Where attempts at physical removal and biodegradable plastics have failed to solve this pollution disaster, synthetic biology steps in. UCL's project proposes the bioremediation of microplastic waste by two systems: degradation using a laccase enzyme or aggregation by controlled expression of curli. Ultimately we envisage the construction of habitable islands - turning waste into a resource. We used novel chassis: two marine bacteria, Oceanibulbus indoliflex and Roseobacter denitrificans. In line with considering the viability of our project, we questioned the access ordinary citizens should have to these tools. Initiating a new partnership, UCL teamed up with a group of 'biohackers' (citizen scientists in molecular biology) to create the world's first 'Public BioBrick'.

Uppsala University

Combating antibiotic resistance - Resistance is futile!

Track: **Health & Medicine** Presentation: **Room 08A00, 9:45h** Poster: **A 03**

Serious infections caused by antibiotic resistant bacteria are a global healthcare problem. As the discovery of new antibiotics lags behind, we are developing new methods for targeting the resistance itself - making resistant bacteria sensitive to old antibiotics once again. Working with real-world resistance genes from multi-resistant bacteria isolated at hospitals, we are developing anti-resistance systems to strike at three different levels: DNA, transcriptional and translational level. At DNA level, we develop a method for increasing resistance plasmid loss rate. At transcriptional level, we use super-repressors to repress transcription of resistance genes and native defense mechanisms. At translational level, we develop a modular system for high-throughput screening of sRNAs to silence resistance genes. We also provide tools useful for the whole synbio community, such as new standard backbones and methods for scarless gene deletion. With this team on this project, there is no question about it: Resistance is futile!

UTBC-RDCongo

E. coli as biodegradeur of organic waste (E. coli comme Biodegradeur des dechets organiques)

Track: **Environment** Presentation: **Room 06A00, 15:15h** Poster: **B 46**

In our work, we used the *Streptomyces coelicolor*, which is known for degrading organic waste, and *Escherichia coli* as biological materials. We searched the gene of *S. coelicolor* responsible for the degradation of organic waste and have inserted it in the *E. coli* so that it can express this activity. We have genetically transformed bacteria in biodegrader of organic waste. We have cloned the expression on biodegradation for the *S. coelicolor* to the *E. coli*.

Valencia

Project Synechosunshine: photosynthetically powered biolamp

Track: **Energy or Food** Presentation: **Room 08A00, 12:15h** Poster: **A 45**

We present an artificial consortium between 2 specialized bacteria by the means of genetic engineering, in order to obtain a photosynthetically fed biolamp. It is a novel proposal of synthetic ecology, based on the use of an efficient photosynthesizer (the cyanobacterium Synechococcus elongatus) modified to become an exporter of sucrose and diel switch of the activity of Aliivibrio fischeri, a marine bacterium widely known for its bioluminescent properties in response to quorum sensing signals. Our modified cyanobacteria feed the population of A. fischeri through a transporter protein and produce AHL to induce bioluminescence in response to the activity of a photosensitive operator, which would activate only at night. We also have tried to transform different microalgae with bioluminescence genes to test their effectiveness. We look forward to develop an efficient and autosufficient environmentally friendly biolamp, with potential application to cover the illumination needs of many infrastructure sectors.

Valencia Biocampus

Talking Life

Track: **New Application** Presentation: **Room 02A00, 15:15h** Poster: **B 24**

Do you speak to your bacteria? We do. We have designed, constructed and characterized an inter-specific translator based on light pulses that allows to literally dialogue with microorganisms. We have built seven biobricks with fluorescent proteins under the control of environmentally-sensitive promoters. The process is as follows: human voice messages are electronically- and then light-encoded in excitation wavelengths, and microbial proteins' emission wavelengths are electronically- and voice-encoded back. We have used this system to find out the fermentative status of budding yeast and to dialogue with *E. coli* allowing it to answer questions such as 'are you hungry'? The three pillars of our project (human practices, modeling and wetlab) yielded continuous feedback with each other, illustrating an integrated interdisciplinary approach. For example, in human practices, we qualitatively analysed the risk of cheater mutants ('liers'), which was quantitatively supported by our results in both our modeling simulations and in the wetlab.

Wageningen UR

A standardized tool for site specific drug delivery using Virus-Like Particles

Track: **Health & Medicine** Presentation: **Room 04A00, 14:45h** Poster: **B 30**

Medicines are generally active in a non-site-specific fashion, affecting the whole patient, including healthy tissue. Therefore, we attempt to specifically target diseased areas by packaging medicines inside Virus-Like Particles (VLPs). VLPs are not infectious, as they are built solely from viral coat proteins. We designed a modular Plug and Apply system that

enables modifications to these coat proteins. The system facilitates the linkage of numerous ligands to the coat protein, thereby creating site-specific carriers. After expression of coat protein genes in *Escherichia coli* the VLPs were assembled in vitro, yielding modified Virus-Like Particles. Medicines can be packed using the Plug and Apply system or simply by addition during VLP assembly. Concluding, VLPs can be used as universal carriers for site-specific drug delivery, allowing customization to a variety of diseases while decreasing side effects for patients during treatment.

Warsaw

B. subtilis: supporting actor of the iGEM stage

Track: **Foundational Advance** Presentation: **Room 06A00, 12:15h** Poster: **A 43**

The iGEM community is far focused on *Escherichia coli* as the model organism, and a vast majority of available BioBricks is designed to work in this chassis. We would like to encourage working with another important bacteria, Gram-positive *Bacillus subtilis*, thus our project aims at obtaining new parts dedicated to this micro-organism. We also design a mammalian BioBrick that opens a new pathway into 'bricking' eucaryotic cells. Our idea is to construct a system enabling us to achieve expression of gene of choice inside a mammalian cell. This system consists of two parts: a shuttle vector, working both in *B. subtilis* and in eucaryotic cells, and an invasive strain of *B. subtilis*. Invasiveness would be achieved by expression of listeriolysin.

Westminster

iSTEM (Intelligent Synthetic Tumor Eliminating Machine)

Track: **Health & Medicine** Presentation: **Room 02A00, 11:45h** Poster: **A 49**

We have created a genetically engineered machine to identify, isolate and eliminate Cancer Stem Cells (CSCs). According to the latest Cancer Stem Cell Theory, not all the cancer cells have the same ability to generate new tumors. Tumor growth is mostly driven by a small proportion of cells, the CSCs. In addition to having high proliferation rates, CSCs are more resistant to chemotherapy. This indicates that while regular cancer cells are killed, CSCs may remain unaffected and give rise to new tumors once the treatment stops. CSCs produce increased levels of a particular enzyme, Aldehyde Dehydrogenase. We have identified its 3 most frequent isoforms (ALDH1A1, ALDH1A3 and ALDH3A1)in aggressive types of cancer, and used their gene promoters to build our CSC-targeting constructs: the iSTEM -Intelligent Synthetic Tumor Eliminating Machine.

ERASynBio aims at promoting the development of synthetic biology by structuring and coordinating national efforts and investment, with the final goal of creating a sound European research community in the field avoiding national fragmentation from the very start. We do this by:

1. Supporting the emergence of national synthetic biology programs based on a strategic research agenda
2. Transnational funding activities via joint calls (2 joint calls planned)
3. Strengthening the scientific community by offering training and educational possibilities
4. Developing recommendations on governance concepts and regulatory models by integrating ethical, legal, societal and technical aspects of synthetic biology
5. Promoting close cooperation between academia and industry
6. Providing extensive dialogue options and exchange fora in which all stakeholders are to participate

3 calls for twinning on project preparations

2 transnational calls for research projects

2 Strategic Conferences

Workshops on concomitant issues

Supporting the iGEM competition

Summer schools for young researchers

Public engagement activities

DEVELOPMENT AND COORDINATION OF SYNTHETIC BIOLOGY IN THE EUROPEAN RESEARCH AREA

ERASynBio is an ERA-Net in Synthetic Biology launched in 2012 under the 7th Framework Programme.

DURATION

36 months (1.1.2012 – 1.1.2015)

EC FUNDING

1.997.022 Euros
Joint calls will be supported by additional funding from the partners

PARTNERS

16 governmental funding bodies from 12 European Member States and 2 associated countries

COORDINATOR

Dr. Annette Kremser
Project Management Jülich (PtJ)
Germany
e-mail: a.kremser@fz-juelich.de

NEWSLETTER

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