iGEM 2013 High School Jamboree
Program Information

AnatoliaGreece
Bacteria construction that recognise UV and emit alert signal

Track: Health & Medicine
Presentation: Room Stata 32-155, 11:30AM
Poster: #21

Our aim was to construct a bacterium that would recognise UV radiation and emit RFP as an alert signal. Due to the harmful consequences of UV radiation to the human skin, the applications of a construct like this would be numerous. The plan was to insert two genes, one that recognises UV radiation, and one that produces RFP in the plasmid, and connect the two so that the RFP is produced in response to UV recognition.

AUC Turkey
BactoCooler

Track: New Application
Presentation: Room Stata 32-141, 12:00PM
Poster: #13

Just like how it has been in the past, cooling is still a problem today. With the BactoCooler that we have designed, we plan to introduce a synthetic solution to the problem. We will make our engineered bacteria conduct a high efficiency cooling reaction. For the endothermic reaction, we were required to select an organic one. After our research and consultation with chemists, we designated the breakdown of urea. For our bacteria to do this at a significant rate, we are required to use the urease enzyme. Although this cooling is useful and wonderful, there are certain situations in which there is no need for cooling so we had to implement a control mechanism. For the heat sensitive control mechanism, we used the RNA Thermometer. With our BactoCooler's design, we will make a controlled and efficient cooling system. Watch out for us, Global Warming!

Beijing BHSF
Bacteria Engineered to Identify Blood Group Antigens

Track: New Application
Presentation: Room Stata 32-155, 2:00PM
Poster: #1

Blood type antigens are present in red blood cells. They are also present in epithelial cells and endothelial cells. Blood typing is important because it can be used to guide blood transfusion and identification of individuals; in addition, changes in pattern of blood type antigen expression can even predict malignancy. The current blood typing approaches mainly include slide agglutination, absorption-agglutination, PCR-RFLP and PCR-sequencing based method. In this project, we will use bacterial surface display method to display human blood type specific antibody (against type A or type B antigen) section (single-chain variable fragment, ScFv) onto the surface of the bacteria; those bacteria will simultaneously express GFP or RFP. When incubation of the ScFv producing bacteria with blood antigen containing cells, they will adhere to each other if the corresponding antigen exists on target cells, so we can characterize blood types and identify the intensity of the antigens on cell surface.

Beijing HDFLS High

The UV-responsive wintergreen odor generator

Track: Environment
Presentation: Room Stata 32-123, 12:00PM
Poster: #19

The UV-responsive wintergreen odor generator catalyzes the conversion of the precursor salicylic acid to the wintergreen odor methyl salicylate under extensive UV irradiation. The biosynthetic device is composed of two transcriptional devices: Rec A (SOS) promoter (BBa_J22106) and a wintergreen odor enzyme generator (BBa_J45119). The odor generator takes as input extensive UV irradiation and produce as output an enzyme that catalyzes production of an odor from a chemical precursor.

BioscienceDragons AZ

Biopannel

Track: Food & Energy
Presentation: Room Stata 32-123, 2:00PM
Poster: #3

Renewable energy needs are higher than ever before requiring new alternative methods of fuel production. Our team is using E. coli bacteria which we will transform with two new genes. Proteorhodopsin is the first protein produced from the first gene, which is a light driven proton pump that will allow the bacteria to produce ATP from sunlight. The second protein will allow the bacteria to ferment sugars into ethanol. The sunlight driven energy will allow for more of the sugar to be used for ethanol fermentation than actual consumption so the output will be higher. The bacteria will in time be placed in a panel that will allow it to gather sunlight and produce ethanol daily which will be distilled and gathered. For now we are just focusing on the creation of the bacteria with the two new genes.

BV CAPS Kansas

The Effects of Increased Pyruvate Kinase Expression on the Production of Alkanes in Cyanobacteria

Track: Food & Energy
Presentation: Room Stata 32-123, 2:30PM
Poster: #17

Humans rely on carbon resources for nutrition and energy. Through industrialization we have become dependent on non-renewable fossil fuels to the detriment of the environment. Recent research into renewable biofuels has included work on the production of corn-based ethanol and the microbial degradation of cellulose from terrestrial plants. Biofuels derived from these sources are not fully sustainable. Third generation biofuels include those derived from microalgae. Cyanbacteria are microalgae known to fix carbon dioxide into alkanes through the collective processes of photosynthesis, glycolysis, and fatty acid biosynthesis. The CAPS iGEM Team 2013 begins metabolic engineering of these pathways by expressing a rabbit muscle derived pyruvate kinase, known to be a key regulator of glycolysis, within the cyanobacteria Synechocystis PCC 6803 in an effort to increase alkane production. Pathways will be modeled using TinkerCell and assays for the production of pyruvate, fatty acids, and alkanes will be used to characterize our system.

CIDEB UANL Mexico
Thermonator III: The crop guardian

Track: Environment
Presentation: Room Stata 32-141, 2:30PM
Poster: #15

Our project is about a genetic engineered machine in E. coli with the ability to produce Vip3ca3 which acts as a pesticide protein. Vip3ca3 production will be regulated by specific temperatures in order to avoid overproduction and it will show activity against target organisms Coleoptera and Lepidoptera, which are related to a local problem concerning potato crops. The Vip3ca3 production is regulated with a constitutive promoter and a riboswitch that initiate translation around 32°C. Since we want to produce the Vip3ca3 below the 32°C, we use a set of promoter-repressors in order to invert the activation of the protein production. This model may be used as a regulator in future transgenic plant generations for the production of substances against plagues, avoiding pesticide overproduction, thus reducing the effect in Non-Target Organisms and bioaccumulation and can be used with different temperature ranges and/or different proteins to attack other target organisms.

Consort Alberta
ECOS (Environmental COntaminant Sensor)

Track: Environment
Presentation: Room Stata 32-155, 12:30PM
Poster: #12

The aim of this year's Consort high-school iGEM project is to engineer a bacterial strain which can be used to test xylene levels. Every time the oil is transferred there is an opportunity for some spillage. Our project would allow anyone to easily and quickly differentiate between more and less dangerous spills. Early identification of contamination will facilitate rapid clean-up and minimize health risks. Our project has been the development of ECOS (Environmental COntaminant Sensor). The heart of the sensor is an E. coli culture that has been modified to produce GFP when exposed to xylene. Xylene was chosen as a trigger because its presence is well correlated with the presence of the more dangerous benzene/benzene derivatives which are carcinogenic. The XylR transcriptional activator is a protein which in the presence of m-xylene will bind to the Pu promoter resulting in the expression of green fluorescent protein.

CSIA SouthKorea
Connecting ATP and redox pool to bioluminescence improvement.

Track: Foundational Advance
Presentation: Room Stata 32-123, 9:30AM
Poster: #7

Our project aims to improve the bioluminescence system of Escherichia coli in which bioluminescene protein from Vibrio fischeri is expressed. The 2010 Cambridge iGEM team increased the duration of bioluminescence by making H-NS mutant E. coli strains, derepressing the Lux gene repression. We engineered E. coli to overexpress phosphoenolpyruvate carboxykinase (Pck) to harbor a high intracellular ATP concentration and express proteorhodopsin to make ATP production possible when nutrients were limited. However, contrary to our prediction, the intensity and duration of bioluminescence in E. coli did not increase. After further literature search, though, we discovered that replenishing FMNH2 is crucial in maintaining bioluminescence. Therefore, to maintain a high redox pool, our team will utilize pathways that can increase redox pool or couple ATP concentration with NAD+ reduction in response to ATP formation.

Jefferson VA SciCOS

Production of FGF in response to near-anoxic oxygen thresholds

Track: Health & Medicine
Presentation: Room Stata 32-141, 10:30AM
Poster: #4

Wound oxygenation is a key determinant of wound healing because oxygen is crucial to the healing process and for resistance to infection. Angiogenesis, the formation of new blood vessels from existing vessels, is essential for tissue repair and can increase oxygen delivery to wounds, enhancing growth and recovery. Production of growth factors such as fibroblast growth factor (FGF) and keratinocyte growth factor (KGF) can be elevated to promote angiogenesis in possible chronic wounds. To address inadequate oxygen during wound healing, we coupled the VHb promoter to a downstream gene encoding FGF. The VHb promoter is activated at an oxygen threshold below 2%, inducing transcription of the FGF gene in response to hypoxic conditions. We also tested the production of KGF under the influence of various constitutive promoters. This oxygen-sensing device is an addition to the growing treatments targeted towards angiogenesis promotion to improve healing in patients with severe wounds.

Lambert GA

Track: Foundational Advance
Presentation: Room Stata 32-123, 10:00AM
Poster: #6

Lethbridge Canada

Oxytastic! A Synthetic Biology Approach to the Production of Natural Oxytocin

Track: Health & Medicine
Presentation: Room Stata 32-141, 10:00AM
Poster: #18

This project revolves around the production of the hormone oxytocin within a bacterial cell. Due to the short half-life of the hormone, it is difficult to study and expensive to store and transport. The ultimate goal is to allow for oxytocin to be produced quickly, efficiently, and inexpensively to allow healthcare professionals and researchers access to a hormone that is not yet well understood. To accomplish this we will be constructing two separate systems: one to produce the Oxytocin-Neurophysin compound, and the other to produce NEC1, a cleavage enzyme responsible for detaching oxytocin from it's carrier molecule which stabilizes oxytocin. The second system will be optimized to produce NEC1 at a rate that will allow maximal efficiency between production and cleavage. Upon completion, we intend to thoroughly characterize our parts and then submit them to the registry. Our human practices component is rooted in public education about synthetic biology.

MCIT Indianapolis

Early Melanoma Detection Fluorescing Biosensor

Track: Health & Medicine
Presentation: Room Stata 32-141, 9:30AM
Poster: #14

According to the World Health Organization, 132,000 people are diagnosed with melanoma skin cancer each year and 48,000 deaths occur from this diagnosis. The development of a yeast based early detection system has the potential to save thousands of lives. Team MCIT Indianapolis is working on a topical cream that will detect the early onset of malignant melanoma. The biosensor system will be developed within a Saccharomyces cerevisiae chassis, using a plasmid containing Firefly Luciferase and Renilla coding that will enable fluorescence in the presence of precancerous cells. The bioengineered yeast will express the receptor protein FGFR-1 on its surface allowing the device to detect increased levels of Basic Fibroblast Growth Factor (FGF2) commonly expressed by precancerous melanocytes. Detection of bFGF will initiate the production of Firefly Luciferase and Renilla proteins, which will cause the yeast to fluoresce showing the patient where potential malignant melanoma cells may be located.

NC School of Sci Math

Implementation of a Novel Multibiosensor in Detection and Notification of Water Contaminants

Track: Information Processing
Presentation: Room Stata 32-155, 12:00PM
Poster: #8

Biosensors provide a wide variety of applications, particularly analyte detection in the environment. Positive results in biosensors lead to the output of a reporter, commonly in the form of fluorescent proteins. Here we construct a biosensor that is capable of indicating the presence of various pollutants in water through expression of several different fluorescent proteins. We selected lead, copper, phosphate, and nitrate/nitrite promoters and paired them with specific reporter coding sequences. Presence of these ions drives the transcription of specific fluorescent proteins. Detection of these proteins is enabled through a light detection apparatus and the information can be sent to mobile devices in a user-friendly interface via a modified Google ADK. This novel multibiosensor can be implemented to detect pollutants in sewer systems, septic tanks, and other sources of water, and provide an early-detection warning system, preventing the pollutants from causing serious harm to equipment, animals, or people.

NGSS AEI Turkey

Photo-Communicator

Track: New Application
Presentation: Room Stata 32-141, 12:30PM
Poster: #10

Today, communication between bacteria is a very commonly used technique. It is a system which is permanently tried to improve and mostly required for the purpose of enhancing a signal or for activating chain reaction pathways. Our goal is to develop an alternative way of signal transfer instead of the classic manner by using chemicals like the quorum sensing molecule Acyl Homoserine Lactone (AHL) or several inducible promoters. Within our project, we will analyze the potential of a single bacterium to affect another bacterium or colony solely by the products of simple biochemical pathways like light or color and finally the effectiveness of the whole system. Regarding the importance of safety procedures, we will test the ability of a colony to induce the death of another colony by ‘’photo-communication’’ and the effects on developing a secondary resistance beside the backbone resistance against contamination cases. Be ready for a grand innovation!

Salonica Schools

Eco-filters

Track: Environment
Presentation: Room Stata 32-123, 12:30PM
Poster: #9

This year's project aims on modifying e.coli bacteria so that they identify CO and emit red fluorescent protein and green fluorescent protein for different concentrations. The project's main application will include installation of ecological filters in factory or household chimnies and detect harmful emissions of CO and other substances and inform the users about the filters' integrity and ensure the smooth functionality of the machinery in use. Our project was unfortunately not completed due to time constraints and limited budjet, but the students have acquired valuable knowledge on synthetic biology and the principles of genetic engineering and have broadened their ecological thinking and the application of technologies to support the environment.

SharonBasicallyAcid
SuperBacteria

Track: Environment
Presentation: Room Stata 32-141, 2:00PM
Poster: #11

Our SuperBacteria will detect dangerously low or high levels of various nutrients, indicate a fluctuation with a flashing red or green light, and correct the concentrations by secreting or absorbing the appropriate nutrient. It is the savior of hydroponics that the world has been looking for! Hydroponics is a system in which plants are grown in a nutrient-rich solution. These bacteria are self-sustaining and will cut the costs of expensive machinery that is currently required to monitor nutrient levels. Currently we are working on having our SuperBacteria detect and indicate non-ideal levels of pH.

Shenzhen SFLS
Detection and Digestion of Phosphates: A Method in Eutrophication Response

Track: Environment
Presentation: Room Stata 32-155, 9:30AM
Poster: #20

Eutrophoication is mainly caused by too much phosphate and nitrogen in water and it can cause serious affction towards environment. When Eutrophication occurs, water-bloom will explosively boosted in water and caused heavy casualty of aquative living beings due to hypoxia. Our project is working on digesting phosphate in water. Due to our research, once we control the N/P ratio can we effectively control the situation of Eutrophication. And we manily focus on digesting Phosphate. Our project is consited of two connected devices. The first device contains a phosphate sensitive promoter which can be induced by phosphate starvation, a RFP system, and a supressor protein. Device 2, contains a promoter which is limited by the suppressor protein featured in Device 1, a PPK coding sequence that is key in digesting phosphate and a GFP with LVA that allows the bacteria to emit a green fluorescence while it is doing so.

Shenzhen SZMS
The biosensor of nitrate and nitrite

Track: Environment
Presentation: Room Stata 32-155, 10:00AM
Poster: #16

Nitrate (NO3-) and nitrite (NO2-) are chemical roots of nitric acid (HNO3) and nitrous acid (HNO2) respectively. They exist in the aquatic environment, the living organisms and artificial products, as pollutants, which can cause food poisoning, cancers or even death. It's important to detect and eliminate such chemicals with the efficient methods. Based on the previous work of the UT Dallas 2010 and Cambridge 2009, the goal of our project is to provide an efficient and a more environment friendly method of detecting nitrates/nitrites and we strive to design biosensors to avoid the disadvantages of traditional methods. To be more specific, our team aims to create a new and efficient biosensor by adding our own design into the previous parts as improvement.

St Pauls London
Semi-quantitative lactose biosensor

Track: Health & Medicine
Presentation: Room Stata 32-155, 10:30AM
Poster: #5

This year, our aim is to mutate E.coli to create a semi-quantitative lactose biosensor; we intend to create three mutant operons on a single plasmid, with each operon responding to a different concentration of lactose in the environment the E.coli finds itself in. We plan to use red, yellow and green fluorescent proteins in a “traffic light” system, whereby the colour of the protein translated corresponds to the concentration of lactose, with red fluorescent protein denoting a high concentration of lactose, yellow fluorescent protein representing a low concentration of lactose and green fluorescent protein showing that there is no lactose present. It is our hope that this could potentially be used in allergy testing and in the analysis of food samples, and by a spectrum individuals who are lactose intolerant.

The Agency Escondido
Rock, Paper, Scissors

Track: New Application
Presentation: Room Stata 32-141, 11:30AM
Poster: #2

Our game of Rock, Paper, Scissors has three different E.Coli systems. Each strain is composed of an inducer coding region upstream of an inducible promoter, and a fluorescent protein (green, red, or cyan). When two different strains are inoculated and mixed on the same agar plate, an inducer coded by the losing strain will contact the winning strains promoter, causing the victor strain's expression of fluorescent protein. The victor will be visually identifiable because of its specific fluorescent protein. Our design is dependent on successful extracellular signaling inducer's affinity for water; only a hydrophobic inducer will be able to travel across cells. We will be using this experiment to test Lamda cl repressor's and Lux cassete protein's solubility in water.

TPHS SanDiego
Engineering a Repressible Promoter from the LasR Quorum Sensing System found in Pseudomonas Aeruginosa

Track: Foundational Advance
Presentation: Room Stata 32-123, 10:30AM
Poster: #23

In an effort to expand the toolkit available to synthetic biologists, we've taken a system natively responsible for transcriptional activation and modified it to control transcriptional repression. The LasR system from Pseudomonas Aeruginosa requires the presence of a small molecule, C12-3-oxo-AHL, to induce activation of the Plas promoter. By modifying the -10 and -35 sites of the promoter, as well as shifting the location of the LasR binding sites, the new Plas promoter (Plas*) was changed from an inducible to a repressible promoter. Through adding this second functionality, the Plas* promoter could be used in conjunction with a wildtype Plas promoter to control two separate genes whose expression levels are always out of sync. Furthermore, if the bacteria are transfected with a plasmid encoding LasI, the bacteria will be able to turn off gene expression at a critical population density, instead of only being able to turn on gene expression.

UCL Academy
Mutare Papyrum

Track: Environment
Presentation: Room Stata 32-123, 11:30AM
Poster: #22

12.5 million tonnes of paper and cardboard are used annually in the UK. We are proposing an alternative solution, a home system that converts cellulose into glucose that allows the up-cycling of paper into a commercial product of PHBs. Consumers who have the home system would be able to rather than put the bio-plastic into a recycling bin to be collected, they can instead exchange their bio-plastic for money. Exchanging recyclable objects for monetary gain, has been used in many European countries where the consumer exchanges plastic and glass bottles. We decided to construct a two stage apparatus containing two reactors- first reactor contains cellulolytic enzymes that output glucose. A filtered feed from the first enters the second (containing Cupriavidus metallidurans), a PHB producing organism. Ideally we would like both parts to be contained in one stage reactor where all organisms and enzymes would be placed in one compartment.