

Fundraising Proposal - CLS-CLSG iGEM team

What is iGEM?

iGEM is an international synthetic biology competition in which multidisciplinary teams (usually university students) work together to design, build, model and test a modified bacteria system.

A successful project must solve a pressing problem by creating genetic circuits, software and mathematical models whilst engaging with the local community through outreach programs. Typically the leading research-driven universities such as Harvard, Stanford and MIT field strong teams of undergraduate students.

Who Are We?

We are a group of students from the City of London School and the City of London School for Girls in London, UK between the ages of 15 and 17. In 2017 our school team was awarded a gold medal alongside teams from Harvard and MIT and won four special prizes: best software, hardware, integrated human practices and composite genetic part. This year we hope to claim more medals and prizes than ever before in recognition of our cutting edge research and outreach programs.

Project Overview

Our project aims to provide a biological solution to the universal problem of concrete stability. Road and pavement structures are rendered highly unstable over time due to uncontrolled weed growth. As of today, persistent chemical treatment is the only way to address this.

We aim to solve this by producing a biologically active concrete capable of self-regulating the production of herbicide, in order to kill any plants that grow in areas of infrastructural weakness.

The concrete will contain genetically modified *E.Coli* that will release ethanoic acid (a herbicide) in response to factors associated with crack formation (such as oxygen). This will stop the growth of weeds in concrete. Our research could be applied to modifying *Bacillus Subtilis* (a bacterial endospore resistant to heat and low pH) in the future.

The modified bacteria will be contained through reliance on a matrix for survival, eliminating the risk of bacteria contaminating the landscape. For further regulation, kill switches will be researched, ensuring set conditions will result in bacterial cell death, preventing bacterial contamination.

Necessity of the project

Plant growth must be controlled for the following reasons:

1. Structure - weed growth can destroy paving surfaces, force kerbs apart and crack walls, compromising the structural integrity of roads and buildings.
2. Safety - weed growth can interfere with visibility for road users and obscure traffic signs. Weeds in kerbs or around drains can prevent or slow down drainage, increasing the risk of flooding.
3. Cost - Roads and buildings made of concrete require a lot of expensive maintenance due to organic corrosion. The EU's annual cost of plant corrosion prevention is €0.05 – €0.15 per m². Approximately 14 billion m² of land is paved or otherwise built on in the UK. This puts the potential cost of killing weeds alone at £1.5 billion in the UK. This does not account for reparation of damage as a result of plant growth such as relaying pavements and roads.

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Estimated Costs

All costs are estimations based upon a previous project in 2017:

- Registration: £ 8000 - £9000
(Initial competition registration fee and Boston Jamboree registration fee)

Description	Estimated Cost	Notes
iGEM Registration	£4,195	
Giant Jamboree registration	£4,240	£530 per participant (8)
Total	£8,435	

- Research Equipment £2000 - £6000
(Includes: PCR clean up kit, Plasmid miniprep kit, Nuclease Free Water.
This is currently our best estimation of research costs)
- Travel (Airline Tickets) accommodation and food £8000 - £10,000

Description	Estimated Cost	Notes
Airline tickets	£3,100	Tickets are currently £270 pp. Will increase as time passes
Accommodation	£4,000	6 students and 1/2 teachers (Only 6 members of the team will fly to Boston)
Food budget	£1,450	£30 per person per day, plus emergency money
Total	£8,550	

TOTAL COST: £18,000 - £25,000

Previous sponsors:

Due to the cost of this project, we will rely on sponsors to support us through the iGEM competition. Sponsors will have an instrumental role in enabling us to carry out this challenging and exciting research. In previous years, City of London teams were able to rely on generous sponsorships from several Worshipful Companies and Biotech firms such as Abcam and IMMUNOCORE. Through generous donations, such companies were put at the heart of our project, facilitating the growth of the next generation of biochemists.

The donations of sponsors, along with the support of Alumni and Parents, enabled the past project to develop and become successful. Previous sponsors received much mention on project websites and in presentations in Boston.

These sponsors will all be contacted again as well as pursuing new opportunities.

Potential Future Improvements:

iGEM encourages the sharing of research to promote rapid and thorough development of ideas. All projects from previous years are readily available to the public and competitors for further development. Thus, our project can be developed by anyone within the scientific community should they find new applications and specialisms. Potentially, this could include coupling our project with self-healing concrete, an improvement we hope to research further.