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Top prize for Cambridge in genetically engineered biological machine competition

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Gold awards and a prize for the best genetically engineered biological ‘machine' went to a team from Cambridge participating in an international competition.

Student teams had the opportunity to use relatively simple biological components to design and create an organic machine, which could then be operated in living cells, as part of the international Genetically Engineered Machine (iGEM) competition.

Genetic engineering has now reached the point where design principles and assembly techniques can be employed to construct biological systems, an area known as synthetic biology.

Microscopic biological ‘machines' are engineered as the components for these systems. Each of these components, known as BioBricks, has a precise specification for its design and function.

The Cambridge team won the iGEM prize for Best BioBrick for their creation of a system for communication within a single cell. Their BioBrick was designed to increase the flow of information in a DNA-based circuit in a living cell, rather like the flow of current in an electric circuit.

The team also worked on two other projects for their competition entry. One of these involved developing a new cellular ‘chassis' for BioBricks from a bacterium not widely used by synthetic biologists. They chose a bacterium commonly found in soil, B. subtilis, widely used in laboratory studies since its genetic manipulation is relatively easy.

B. subtilis is a useful choice because it falls into a class of bacteria different from those normally used in synthetic

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biology. Bacteria can be divided into two major groups based on whether or not they retain a violet dye, applied in a process known as a Gram-stain. Those bacteria that retain the dye are known as Gram-positive, those that do not are Gram-negative.

Whether an organism retains the dye depends on the nature of the rigid layer which surrounds bacteria cells, known as the cell wall. Gram-positive bacteria have a very thick cell wall, whilst the walls of Gram-negative cells are thin.

Although synthetic biology relies on Gram-negative cells, biotechnologists generally use Gram-positive cells, hence the advantage of creating a Gram-positive ‘chassis'. In addition, Gram-positive cells absorb and secrete various substances more efficiently than those that are Gram-negative, which reduces the ‘interference' in communications between cells.

This was the focus of another part of the Cambridge team's entry. They worked on a new signalling mechanism for communication between distantly related bacteria, specifically B. subtilis and E. coli, the Gram-negative bacterium synthetic biologists have worked with so far.

Synthetic biology is currently very short of inter-cellular signalling systems. The main system currently used, based on Gram-negative cells, has problems involving the transmission of unwanted signals – the biological equivalent of crossed lines on a telephone.

Gram-positive cells, on the other hand, have many well-studied signalling systems. The Cambridge team converted a naturally occurring example of this into a usable device.

The BioBricks devised by the team have now been added to an international registry, organised by the BioBricks Foundation, a not-for-profit organisation started by American engineers and scientists.

As with all registered BioBricks, their designs are now available for free to researchers around the world, who can incorporate them into their own biological devices, or modify and improve them as they see fit.

The Cambridge team was supported by groups across the University. The Departments of Genetics and Physiology, Development & Neuroscience established special studentships to fund participation in the competition.

Bill Harris, Professor of Physiology, Development and Neuroscience, said: “Genetically engineered machines are

hugely exciting and the teams from Cambridge over the last years have done some amazing things. It's also great that so many of the team are women, since engineering is male dominated."

"We've been very active in promoting the role of women in science and engineering and what could show this more clearly than the success of our team in winning a gold award and the much coveted prize for best BioBrick."

Support also came from the School of Biological Sciences, the School of Technology, the Departments of Engineering, Biochemistry, Plant Sciences, Zoology and Physics, as well as the Isaac Newton Trust, EPSRC, DNA 2.0 and the European Union SynBioComm programme.

The University of Cambridge is currently recruiting a student team for the iGEM2008 competition. Further details can be found through the Haseloff Lab's website (see sidebar)

For further information, please contact the University of Cambridge Office of Communications on 01223 332300

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