DEUTSCHES KREBSFORSCHUNGSZENTRUM
IN DER HELMHOLTZ-GEMEINSCHAFT

No. 52 November 9, 2009 (Koh)

Sweeping Success with Artificial Gene Switches
Heidelberg Students Score at International Competition

At the high-profile international competition in synthetic biology (iGEM) held by the Massachusetts Institute of Technology in Boston, the Heidelberg team of undergraduates has reached a sensational second place in the overall evaluation. Moreover, the team headed by Professor Roland Eils of the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) and Heidelberg University has been awarded prizes for the best new standard and the best internet presentation (wiki). Thus, the Heidelberg team outperformed all other teams from top universities in the U.S. and Asia

iGEM – this acronym stands for the world's most important student competition in synthetic biology: the "International Competition of Genetically Engineered Machines". More than 110 teams from the world's leading universities with over 1,100 students came to Boston at the past weekend to participate in MIT's high-profile competition in this young and future-oriented science discipline.

Heidelberg reached a sensational second place in the overall performance and was 1st runner up to the team from Cambridge, U.K., which won the Grand Prize. Moreover, the students from Heidelberg were awarded the prizes for Best New Standard and Best Wiki. Last year, the Heidelberg team participated for the first time and won three special prizes straight away so that it was considered a top candidate in this year's competition from the beginning. The team met the expectations supremely well.

Like in the construction of an aircraft, where many prefabricated parts are assembled, synthetic biology uses simple genetic building blocks and combines these to engineer new complex systems with specific functions. The Heidelberg team had set itself a very ambitious goal this year. Instead of working with bacteria, which have a comparatively simple construction, they attempted to design artificial gene switches for mammalian cells. "Working with mammalian cells is particularly important for us here in Heidelberg, because we aim to apply the methods of synthetic biology in cancer research, too," says project leader Roland Eils. With their award-winning project, the Heidelberg scientists have laid an important cornerstone for applying the concepts of synthetic biology to human cells.

Gene switches, scientifically called promoters, play a central role in the regulation of all cell activities and are thus of prime interest in synthetic biology. Gene switches are areas of genetic material which contain a whole number of docking sites for various regulatory proteins. When these proteins bind to the appropriate docking sites, the structure of the genetic material changes and the respective gene can be read. Promoters regulate when and in which cell type the respective gene is read. By selectively switching specific genes on or off, scientists are able to interfere with specific cellular signaling pathways, e.g. to correct misguided processes in cancer cells.

The thirteen participants of the Heidelberg team have been working on their "Spybricks" project since February in laboratories of the Bioquant Institute. The first aim of the students was to generate new promoter sequences on a random basis and to try out how well these newly created switches function to activate a gene. To this end, the team developed a novel chemical synthesis method in which several DNA sequences with slight differences in the sequence of building blocks are produced from each preparation. Subsequently, the functioning of the different versions in the cell was tested. In another part of the project, the

Heidelberg team used computer-aided methods to design promoters to which very specific regulatory proteins can bind. The aim is to create gene switches which react only to exactly defined stimuli. Here, too, the Heidelberg participants were already able to verify the functioning of the switches in cell experiments.

The sequences of all newly synthesized gene switches have been compiled in a library which is now available for use as “biological building blocks” by all scientists in the area of synthetic biology.

The “Spybrick” project and the promoter library are found on the Internet at:
http://2009.igem.org/Team:Heidelberg

A picture for this press release is available on the Internet at:
http://www.dkfz.de/de/presse/pressemitteilungen/2009/images/iGEM_2009.jpg

The German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) is the largest biomedical research institute in Germany and is a member of the Helmholtz Association of National Research Centers. More than 2,000 staff members, including 850 scientists, are investigating the mechanisms of cancer and are working to identify cancer risk factors. They provide the foundations for developing novel approaches in the prevention, diagnosis, and treatment of cancer. In addition, the staff of the Cancer Information Service (KID) offers information about the widespread disease of cancer for patients, their families, and the general public. The Center is funded by the German Federal Ministry of Education and Research (90%) and the State of Baden-Württemberg (10%).

Dr. Stefanie Seltmann
Leiterin Presse- und Öffentlichkeitsarbeit
Deutsches Krebsforschungszentrum
Im Neuenheimer Feld 280
D-69120 Heidelberg
T: +49 6221 42 2854
F: +49 6221 42 2968
presse@dkfz.de