

Danish Team wins First BIOMOD International Undergraduate Nanobiology Design Competition

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The first annual International Bio-Molecular Design Competition (BIOMOD2011) was held on November 5, 2011, at the Wyss Institute for Biologically Inspired Engineering at Harvard University (Cambridge, MA, USA). BioMod is a design competition for undergraduate students that was founded by Wyss Institute Technology Development Fellow Shawn Douglas. Teams of students engineer novel nanoscale structures or machines that self-assemble from biological macromolecules and have useful biological and therapeutic applications. Twenty-one undergraduate teams including more than 100 students from America, Europe, and Asia participated. The teams designed, built, and analyzed their systems during the summer and then prepared a short talk, a YouTube video, and a Wiki page documenting the project.

The Grand Prize winner and winner of the Best Presentation prize was the Danish Nano Artists team (Fig. 1). Their nanostructure, titled 'Octahedral RNA origami for simultaneous drug delivery and gene knock-down', was a three-dimensional ribonucleic acid (RNA) structure that regulates protein expression in the cell (Fig. 2). It self-assembles from a long RNA strand that is folded into an octahedron by eight shorter RNA strands. The octahedron is cut into several smaller RNAs by the cell's RNA interference machinery. The smaller RNA fragments cause a decrease in the expression of specific target genes. The team included five bachelor's degree students from the Interdisciplinary Nanoscience Centre (iNANO), Aarhus University: Mie Elholm Birkbak, Irene Maria Hansen, Jens Vogensen Biasevich, Hans Christian Høiberg, and Steffen Lynge Sparvath.



Fig. 1. The BIOMOD2011 Grand Prize winning team was the Danish Nano Artists. Pictured from left are Jens Vogensen Biasevich, Irene Maria Hansen, Mie Elholm Birkbak, Steffen Lynge Sparvath, and Hans Christian Høiberg. Picture courtesy of the Wyss Institute.

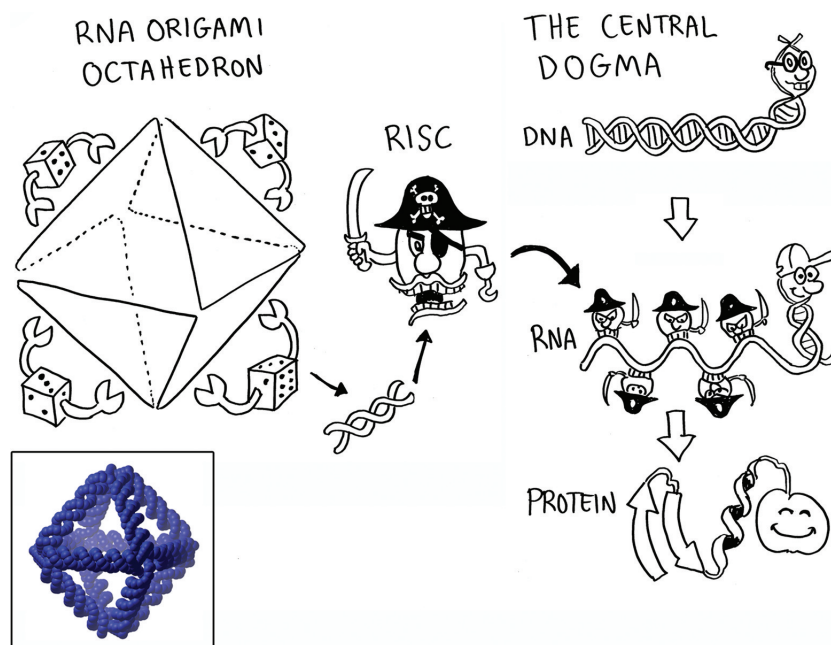


Fig. 2. The Grand Prize winning nanostructure from the Danish Nano Artists was titled ‘Octahedral RNA origami for simultaneous drug delivery and gene knockdown’. In the cell, the octahedron (insert) is cut into several smaller RNAs by DICER, part of the cell’s RNA interference machinery. The smaller RNA fragments block the synthesis of a specific protein by directing the RISC complex to bind to and destroy the mRNA that encodes the protein. Cartoon and insert courtesy of Ebbe Sloth Andersen.

TeamJapan-Tokyo (Tokyo Institute of Technology) won the second place for their project, ‘DNA ciliate’. Team members included Sara Mitsunari, Hideki Kawamura, Ryuichi Kyan, Kaito Sugaya, Zicong Zhang, Hiroshi Matsukawa, Kiyohiko Inoue, and Takafumi Hayashi. The HarvarDNanos (Harvard University) won the third place for their project, ‘DNA Origami Containers’. Team members included Nick Perkons, Shwinn Ricci, Sherrie Wang, and Evan Wu.

The Best Wiki (documentation) and Best YouTube video awards were won by the TUM NanU team from the Technische Universität München for their project, ‘DNAOrigami device to investigate conformational changes of DNA due to interactions with small molecules’. Team members included Silvia Blank, Michael Glück, Florian Helmhold, Sarah Hintermayer, Alexander Hipp, Manuel Hora, Simeon Leupold, Emanuel Pfitzner, Frederik Schreiber, Tom Schwarzer, Jean-Philippe Sobczak, and Martin Thoma.

We asked the Danish Nano Artists Team about their experience in the BioMOD competition:

We enjoyed the competition very much. It was a very interesting and unique challenge because we had to

come up with everything from scratch: getting the idea, preparing the structure and designing and carrying out the experiments. For us this was very different from what we were used to, since most undergrad lab work more closely resembles cooking than science. Also going to Boston for the jamboree was a very good experience and a nice chance of meeting other students from all over the globe.

The most enjoyable part was probably the complete freedom of the assignment. Biomolecular design is a very broad subject, which was also clearly illustrated by the large diversity of the different projects. This really gave us room to be creative and to work with our own ideas, which was great. We would like to recommend the competition to any undergrads who would like a unique and interesting challenge. It is not easy, and it is a lot of work, but it is definitely worth it. (especially if you win).

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