



August 22, 2016
Fukui University
IEEE-ICCSE Satellite Workshop

How to Develop Students' Creativity?

~A Case of Student Competition of Biomolecular Design

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The logo for the International Biomolecular Design Competition (BIOMOD), featuring the word "BIOMOD" in a bold, black, sans-serif font. The letter "O" is stylized with a circular arrow.

International Biomolecular Design Competition

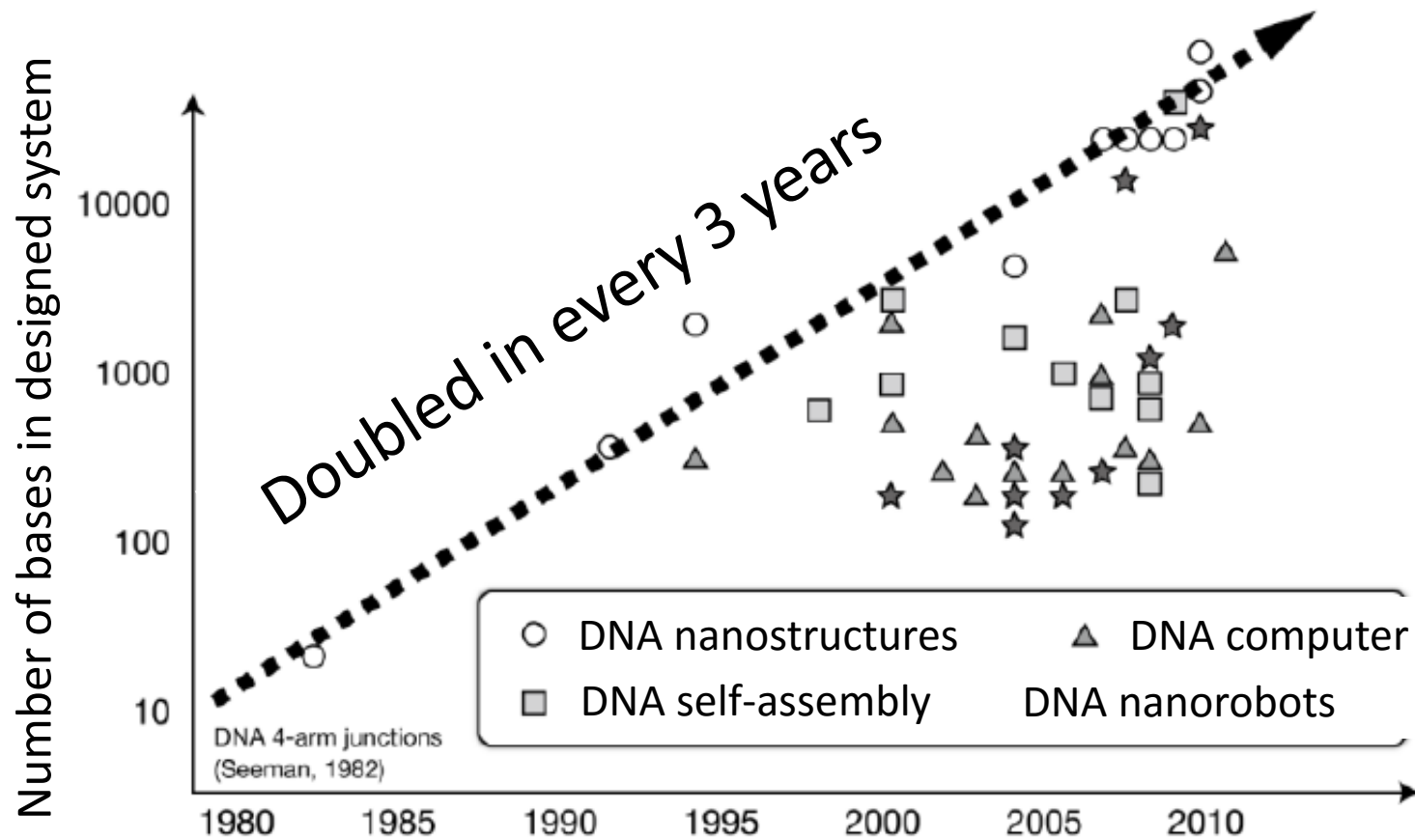
DNA nanotechnology

DNA nanotechnology enables us to realize various nanodevices and nanostructures made of rigorously designed DNA sequences

- DNA Origami
- DNA walker
- DNA computer

Moore's law appeared in DNA nanotechnology

Increasing Complexity of DNA systems



Importance of STEM education

- To master multi-disciplinary subject, ordinary education system do not work very well
- STEM(Science, Technology, Engineering and Mathematics) education integrates them into a cohesive learning program based on real applications
- Biomolecular design is suitable for STEM because it requires broad background in chemistry, biology, physics, computer science and mechanical engineering

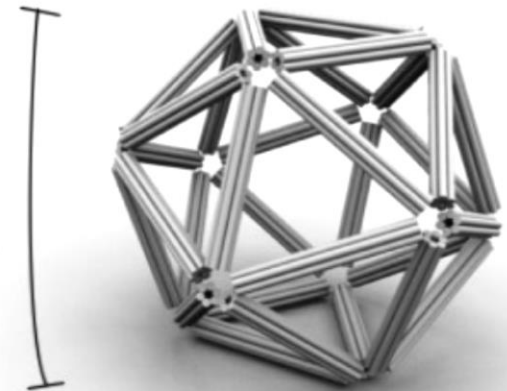
Education through competition

- Competitions in Robotics (ROBOCON) expanding to various field of science and technology
- Focusing on Biomolecular Design Competition (BIOMOD)

**BIOMOD IS A
COMPETITION
FOR NANOSCALE
DESIGN**

ICOSAHEDRON

~100 NM



BIOMOD

- International Biomolecular Design Competition for undergrad students
- Founded in 2011 by S. Douglas at Harvard
- Open-ended competition
- Limited number of participating teams (30)

The logo for BIOMOD, featuring the word "BIOMOD" in a bold, black, sans-serif font. The letter "O" is replaced by a stylized, circular graphic element that resembles a DNA double helix or a molecular structure.

<http://biomod.net/>

Evaluation system of BIOMOD

- Fair judging system similar to that of figure skating, proposed by Japanese research group

Online evaluation		Onsite evaluation
Wiki (50 points) Detailed description of project	Video (25 points) Digest of the project (promotion video)	Presentation (25 points) Oral presentation and discussion
Idea, feasibility Reproducibility Achievements	Impact Simplicity Quality of contents	Clarity Production Impact

BIOMOD schedule

- January–March: Recruit and organize student team (in Japan from April).
- April–May: Register your team. Students should begin independent background reading to start learning about topics Brainstorming meetings to determine project topic.
- June–August: Do the project! Also, start planning the YouTube video as early as possible.
- (September: BIOMOD Japan Meeting)
- September–October: Complete project wiki, video, and presentation. Register for Jamboree

Textbook for Japanese students

- Written by Japanese mentors
- 92 items cover necessary basic knowledge and know-hows
- Free for download at

<http://cbi-society.org/>

Also

DNAナノテクノロジーへの招待
(対話形式のチュートリアル)
「現代化学」誌上で連載中



Japan's Team Sendai wins Grand Prize in 2012 BIOMOD competition



Over 120 students from around the globe presented their designs at the BIOMOD 2012 Jamboree.

November 5, 2012

"Team Sendai" heads back to Tohoku University in Sendai, Japan, with the grand prize for the second annual BIOMOD competition in hand. This was the second year for BIOMOD, an international biomolecular design competition sponsored by the Wyss Institute, with additional support from Autodesk and Mathworks.

BIOMOD, which took place November 3-4 at Harvard's campus in Cambridge, MA, provides undergraduates an opportunity to engineer biological molecules into nanoscale "machines" that can be used for any number of scientific and technological purposes. Seventeen teams comprised of more than 120 students hailed from around the world and presented the projects they've been working on since last spring to an esteemed panel of judges.

Feedback from students

- Faced difficulties
 - Endless trials and errors
 - Difficulties in presentation
 - Difficulties in getting original idea for the project
 - Difficulties in English
- Achievements
 - Learning international perspective (level of other teams/students)
 - Learning experimental skills, learning from mistakes
 - Feeling of accomplishment/team work
 - Getting used to speaking in English/presentation skills

Conclusions

- Getting self-motivation is the most important influence of the competition. Mind of students have been clearly changed from “waiting for information” style to “thinking by themselves as a researcher” type of attitude.
- Giving presentation in English in front of peers provides an opportunity (and certain pressure) to open their eyes to the importance of English communication and the level of global standard.
- Understanding concrete problems need to be solved and thinking ways to solve them is quite effective to learn many different types of methodologies on the job.
- Team work ability is developed through the activities