Exciting Achievement: HongKong-CUHK iGEM 2024 Team Wins Gold!

The HongKong-CUHK iGEM 2024 Team has been awarded a Gold Medal at the International Genetically Engineered Machine (iGEM) 2024 Grand Jamboree, held in Paris, France, from October 23 to 26, 2024. In addition to the prestigious Gold Medal, the team was nominated for the Best Education Award in the undergraduate section. The Hong Kong-CUHK team has been distinguished as one of only five nominees globally, joining one winner and three other nominees in this category.

The Team

The team comprises six undergraduate students from the Department of Biomedical Engineering and five from the School of Life Sciences. The team is co-supervised by Professor NGO Chi Ki Jacky from the School of Life Sciences, Professor CHOI Chung Hang Jonathan from the Department of Biomedical Engineering, and Professor CHAN Ting Fung from the School of Life Sciences. Additionally, four postgraduate students from the School of Life Sciences serve as instructors for the team.

In addition to the school, the team also received support from other external parties, such as Opentrons, a biotechnology company specialising in the production of liquid handling robots. As one of the five teams worldwide awarded this year's sponsorship, Opentrons has supported them with an in-kind donation valued at approximately HK $195,200. This includes the OT-2 robot which allows the team to optimise their workflow and dedicates more time to innovation and outreach.

The Project

The HongKong-CUHK iGEM 2024 Team developed **ResiSense**, a rapid point-of-care test kit for detecting bacterial antibiotic resistance genes. ResiSense offers a fast and cost-effective technology for accurately identifying antibiotic resistance, addressing a global health crisis exacerbated by antibiotic misuse and overuse, which is responsible for millions of deaths, particularly in underdeveloped regions. Current diagnostic methods often require highly trained personnel and expensive on-site equipment,

making them impractical in low-resource settings. To mitigate these challenges, the team proposed ResiSense, a cell-free point-of-care strategy designed to rapidly detect bacterial antibiotic resistance genes.

In the presence of a targeted resistance gene, a selected G-quadruplex DNAzyme is produced from a specially designed DNA template through rolling circle amplification (RCA). The DNAzyme oxidizes colorless tetramethylbenzidine (TMB) into blue TMB^+, enabling colorimetric detection. As proof of concept, the team generated a non-infectious *Escherichia coli* strain containing a snippet of blaKPC2, an antibiotic resistance gene from *Klebsiella pneumoniae*, and successfully detected the gene via the RCA-generated DNAzyme.

The Campaign

Inspiring the next generation and fostering connections within the scientific community are key components of their project. Beyond laboratory work, they aim to share their passion for synthetic biology with the broader community through various outreach initiatives, including activities focused on human practices and education.

For human practices, the team consulted a wide range of stakeholders to understand the complexities of antibiotic resistance genes and the challenges of implementing their kits in real-world settings. These interactions provided invaluable insights that guided their probe selection, kit design, target market identification, and educational programs. The team engaged with experts in infectious diseases and biomedical fields, including Professor Margaret IP and Professor TSUI Kwok-Wing Stephen. Additionally, discussions were held with Dr. Pierre Chan, a respected doctor and former legislative councillor, and Dr. Edmond Ma, an antibiotic resistance expert from the Center for Health Protection. The team also consulted science educators Dr. Helen MA and Dr. LAU Kwok-chi Victor to shape their educational programs.

Nominated for the Best Education award in the undergraduate section, the team approached their educational initiatives by collaborating with communities to identify knowledge gaps and develop tailored programs based on specific needs. Over the summer, they created workshops for university students, high school students, younger children, and local iGEM communities.

At the CUHK Art Fair aimed at university students, the team addressed misconceptions about antibiotic resistance through interactive games. For younger children, they organised a Community Centre Workshop to introduce the basics of DNA and synthetic biology through playful experiments and crafts. Their Gel Electrophoresis Troubleshooting Workshop targeted local high school students, providing hands-on experience with lab techniques and critical thinking skills needed to troubleshoot experiments.

For the iGEM community, the team initiated a Regional Symposium with other Hong Kong iGEM teams, attracting over 100 participants. The event featured presentations, poster sessions for networking, and expert talks on science communication. Furthermore, the team collaborated with CityU and HKUST iGEM teams to share their personal journeys in synthetic biology with younger students, offering insights into academic and career paths in biotechnology.

About iGEM

The International Genetically Engineered Machine (iGEM) is a leading global synthetic biology competition held annually for high school, undergraduate, and postgraduate students. Founded by the Massachusetts Institute of Technology (MIT) in 2004, iGEM aims to enhance education in synthetic biology, encourage collaboration, and nurture talent in the field. iGEM projects focus on utilising synthetic biology to address real-world challenges through research, both within and beyond the laboratory.

At the end of each iGEM season, a Grand Jamboree is held where each team presents their work to judges and other teams at a designated venue. The 21st Jamboree in 2024 featured a total of 414 participating teams from over 50 countries and regions, with approximately 5,000 attendees.