Background info on Intel ISEF 2019

There were 22 scientific categories in Intel International Science and Engineering Fair (Intel ISEF) 2019. Within each category, the following awards were presented – *Best of Category*, *First*, *Second*, *Third* and *Fourth* awards.

The *Best of Category* project was selected on the basis of outstanding and innovative research, and potential impact of the work in the field and on the world at large. For more information on the Intel ISEF, please refer to: https://student.societyforscience.org/intel-isef.

Details of projects submitted by the Singapore team

Students	Project Description and Students' Insights
Tan Yee Lin (Individual) IP Year 6 National Junior College	**Nature-Inspired Bactericidal Nanotextured Surfaces with ZnO Nanostructures** Yee Lin's project was inspired by the wings of the Clanger cicada, where she synthesised a novel antibacterial surface that kills bacteria using a physical rupture mechanism, and was fabricated simply by boiling zinc in water. This surface possesses superior bactericidal performance, is highly cost-effective and does not induce additional antimicrobial resistance formation, highlighting its potential to be used on frequently touched exteriors such as hand-railings, door knobs and elevator buttons. Through the project, she learned about the importance of exploring new possibilities and the key role of creativity in scientific research. Only through being creative and thinking outside the box can one come up with new discoveries that can make a positive change to the lives of the people around us.

Students	Project Description and Students' Insights
Jovan Yap Zheng Feng (Individual) IP Year 6 Dunman High School	**Effectiveness of Detergents Analysed using Rotating Magnetic Nanoparticles** Jovan's project involved the development of an innovative detergent characterisation technique that is environmentally friendly, cheap and fast. This involved mixing magnetic nanoparticles with detergents and placing them in a rotating magnetic field. The breakthrough of this project was the discovery that the strength of detergent could be tested by determining the amount of coating on the magnetic nanoparticles that the detergent has broken down. Despite the tough journey of research, Jovan gained insights and personal growth, which he acknowledged was more important than the end result.
Kwek Zhong Wei, Isaac **Tan Yi Jie, Valerie** (Team) IP Year 6 Dunman High School	**Zinc Oxide-Capped Carbon Nanoforest: Novel Method of Defects Engineering via Focused-Laser-Beam Modification** Using a focused laser beam, Isaac and Valerie synthesised a new material by controlling defect-introduction on a zinc oxide-capped carbon nanoforest for the use of field emission. This new material produced a higher current stability and required a lower turn-on voltage than current field emitters which shows potential to reduce costs. To prevent over-heating of this new material, they discovered the synergistic effect of field emission together with photo-enhancement to produce an even higher current. Throughout their research journey, Isaac and Valerie felt privileged to be mentored by passionate and experienced scientists, and connected with many inspirational individuals with a common love for science. They felt that the process was undoubtedly mentally, emotionally and spiritually fulfilling.

Students	Project Description and Students' Insights
Natalie Elizabeth Yam (Individual) IP Year 6 Anglo-Chinese School (Independent)	**Origami Paper Parachutes in HADR Operations** Natalie designed and tested origami paper parachutes for use in humanitarian aid and disaster relief operations. Through experimentation, her origami paper parachute showed potential as a viable alternative to conventional parachutes that are non-biodegradable. Through the project, she learned to enjoy the process of discovery instead of being fixated on getting results. She also learned the value of perseverance in the face of failure.
Liu Haohui (Individual) IP Year 5 Raffles Institution	**Data Analytics for Fake News Detection** In order to combat the rise of fake news, Haohui developed a machine-learning approach of detecting fake news early and with high accuracy. Regardless of the source of news, this approach analyses the text of the article directly to determine if it is real or fake. Haohui had a lot of fun doing this project as she learned how to apply machine learning techniques to solve real world problems. She enjoyed the self-directed learning process through utilising online resources to solve problems that she encountered.

Students	Project Description and Students' Insights
Clive Choong **Harish Kumaar S/O Tamil Selvan** **Yap Yi Tern, Elden** (Team) IP Year 6 NUS High School of Mathematics and Science	**Graphene-Enabled Templating Synthesis of Metal Origami for Next-Generation Soft Robotics** Soft robotics has the potential to revolutionise the field of prosthetics. Current soft robots can be bulky and inefficient since they require many separate components to be installed. To address this issue, Clive, Harish and Elden successfully developed a novel material for soft robotics that is simultaneously flexible, conductive, durable & magnetic; and thus has the potential to move, sense and communicate. They learned that teamwork is necessary to overcome the challenges faced along their journey of discovery. Overall, their experiences in the fair and their own learning through research was more meaningful than the final result. The friendships and connections forged throughout the whole experience will stay with them for life.