

Press Release

Singapore – 11 January 2017

For immediate reporting

Temasek Foundation Ecosperity funds innovative proposals that aim to enhance Singapore's liveability

Spurring development of solutions to address environmental, biological and other adversities in an enduring and sustainable way, the Foundation is providing approximately S\$6 million worth of funding support to four projects.

1. Temasek Foundation Ecosperity (TF Ecosperity) announces its funding support of approximately S\$6 million for four innovative projects that propose to deliver real and substantial improvements in our liveability conditions. The Foundation seeks to help innovators overcome initial obstacles to reach a stage where they can demonstrate the effectiveness of their ideas for eventual application.

2. This is the first batch of proposals supported by TF Ecosperity. The aim is to bring about enduring solutions, systems and capabilities against environmental, biological and other adversities in Singapore and beyond. Through its funding and facilitation, the Foundation strives to develop and nurture a vibrant ecosystem for innovation and entrepreneurship as well as promote sustainable best practices and standards so that the wider community can continuously respond to the ever challenging impositions on our living environment.

3. The four proposals and their key solutions:

- (i) Building a Quick Response to Mass Disease Outbreaks Starting With a Therapeutic for the Zika Virus. The project aims to build a quick development capability to produce a treatment against the Zika virus, with the objective of reducing time for a product to reach clinical trials from as long as five years to just under one year. The funding will allow the verification of the regulatory approach through discussion with regulators on accelerating preclinical development with subsequent financial support from government and industry partners for market deployment.

Tychan Pte. Ltd. has developed a technology that enables rapid deployment of antiviral agents. This technology was successfully demonstrated in the development of antivirals against the Ebola virus.

Funding from the Foundation will be used to build a small-scale facility, capable of producing an initial batch of about 50 to 100 doses of antiviral agents. When established, the facility can be used for the development of other antiviral agents against viruses that cause mass outbreaks.

Following successful testing with an initial batch of antivirals, Tychan will be seeking regulatory approval and partner with a major pharmaceutical company to produce an antiviral therapeutic in sufficient quantity for mass deployment.

- (ii) Bio-based Platforms for Mosquito Vector Control. This project on mosquito control involves the isolation of effective compounds from plants known to have larvicidal activity, and to develop alternative bio-pesticides such as larvae control sprays, air diffusor oils and repellents against larvae and adult mosquitoes.

The second leg of the research involves the building of an Arthropod facility for conducting research into more precise methods of killing specific mosquito species without affecting other insects and living organisms. Temasek Life Sciences Laboratory Limited will be studying into the use of double-stranded RNA-mediated gene silencing (or RNAi) to repress certain mosquito genes.

- (iii) Air+ Smart Mask and Micro Ventilator for Younger Children. A new smart mask and micro ventilator will be specially designed by Innosparks Pte. Ltd. to comfortably fit faces of younger children from ages three to six. Current versions of the smart mask and micro ventilator are only designed for adults and children older than seven years old.

- (iv) Test-bedding Airbitat Smart Coolers for Air Filtration Capabilities. Six additional Airbitat Smart Cooler prototypes will be deployed by Innosparks for test-bedding at various public spaces in Singapore. The increase in prototypes supplements units currently deployed around Singapore, including at the Singapore Zoo. Compiling data from different environmental profiles will allow Innosparks to support future research and development. This could extend Airbitat's current air cooling capabilities to include additional functions such as air purification and air filtration.

(See Annex for profiles of companies/ researchers and details of their proposals.)

4. Mr Teo Ming Kian, Chairman of Temasek Foundation Ecosperity, said: “We want to encourage more ideas and solutions that address challenges we face in our living environment. Not all proposals we support will eventually be successful, but we want to lend a helping hand to get people to take their ideas off the ground so that for those that do succeed, they would be proud to have contributed to a better Singapore for generations to come and to bring their solutions to other cities as well.”

5. “The four proposals we support are good examples of the types of problems we would like innovators to help solve. A city is liveable not just with clean water and green surroundings. The recent Zika outbreak in Singapore shows that we must have good effective responses to infectious diseases when they come to the shores of our open and globalised city. It would boost the confidence of our people and visitors that we are able to counter an infectious disease outbreak should that happen. Infestation of mosquitos also affects our living condition by virtue of the fact that they are prolific disease carriers. We should look for solutions to control the mosquito population so that we do not unwittingly (or undeservedly) end up having a reputation as a hotbed of disease outbreaks. While we would have to look for more permanent solutions to solve the problem of haze, we will have to find ways to protect all our people, old and young when it should come our way. Similarly, with the number of hot days in Singapore projected to increase, lowering the outdoor temperature in our hot weather would vastly improve our liveability,” Mr Teo added.

About Temasek Foundation Ecosperity

Temasek Foundation Ecosperity is a Singapore-based non-profit philanthropic organisation that funds and supports strategic and impact-driven programmes focusing on championing the sustainability of our global ecosystem and the development of innovative solutions to improve liveability.

Established in 2016, it aims to bring about enduring solutions, systems and capabilities against environmental, biological and other adversities in Singapore and beyond. It also strives to develop and nurture a vibrant ecosystem for innovation and entrepreneurship, as well as promote sustainable best practices and standards.

Temasek Foundation Ecosperity is a member of the Temasek Philanthropic Platform, which was established by Temasek to better serve the evolving needs of the wider community, reinforcing its approach to sustainable giving. Since its inception in 1974, Temasek has established 17 endowments, which focus on building people, building communities, building capabilities and rebuilding lives.

For more information on the Temasek Philanthropic Platform, please visit www.temasekfoundation.org.sg.

For more information on Temasek Foundation Ecosperity, please visit www.temasekfoundation-ecosperity.org.sg.

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Profiles of Companies/ Researchers and Details of Proposals

1. Tychan Pte. Ltd.

Tychan is establishing a framework for rapid response to emerging pathogens. Key to this framework is developing an integrated technology and regulatory platform for rapidly producing therapeutic agents at current Good Manufacturing Practices (cGMP) scale against emerging infections. To be pertinent for an outbreak response, a major focus of Tychan is to reduce the time from therapeutic development to clinical application. This strategy will reduce reliance on traditional manufacturing timelines, create flexibility in production and study design to accelerate translation from preclinical studies to clinical trials. Tychan's integrated approach puts Singapore and Asia on the map to address and manage such emerging pathogens that impact local as well as global economies.

People

Founded in Singapore by Dr Ram Sasisekharan and Dr Eng Eong Ooi, professors at the Massachusetts Institute of Technology (MIT)/ Singapore-MIT Alliance for Research and Technology (SMART) and Duke-NUS Medical School/ SMART, respectively, their expertise spans the fields of glycan biology, biologics development and biology of acute viral infections. Alongside the founding Directors, Associate Director Megan McBee manages day-to-day research and development activities.

Dr Megan McBee received her SB in Chemical Engineering from MIT in 2002 followed by PhD in Molecular and Systems Bacterial Pathogenesis from the Department of Biological Engineering at MIT in 2007. Her research interests and background ranges from mucosal immunology to bacterial pathogenesis and drug resistance. She conducted postdoctoral research with SMART in infectious diseases and at the University of Chicago in immunology. Prior to joining Tychan, she had been residing in Singapore since 2012 as a Research Scientist in SMART.

2. Temasek Life Sciences Laboratory Limited (TLL)

TLL, established in 2002, is a beneficiary of Temasek Trust and its vision is to build a preeminent organisation of global talent to undertake bio-molecular science research and applications to benefit people in Asia and beyond. The research institute focuses primarily on understanding the cellular mechanisms that underlie the development and physiology of plants, fungi and animals. Such research provides new understanding of how organisms function, and also provides foundation for biotechnology innovation. For more information, please visit www.tll.org.sg.

Proposal on Novel Bio-based Platforms for Mosquito Vector Control

Mosquitoes transmit some of the world's most life-threatening diseases, such as malaria and dengue, which are on the rise in many tropical and subtropical regions including Singapore. Chemical or synthetic pesticides and mosquito repellents are currently used widely to control mosquitoes at larval, pupal and adult stages. These pesticides may be harmful to the environment as well as other insects prompting a need to search for safer alternatives to the synthetic chemicals currently used to reduce the incidence of vector-borne diseases.

There are two parts to TLL's Mosquito Vector Control Research; firstly, to develop alternative non-toxic natural compounds that are extracted from plants used traditionally for biocontrol of mosquitoes. Secondly, to establish an in-house Arthropod Facility to conduct pioneer studies on effective larvae and adult mosquito control at the gene level, using the well-established double-stranded RNA (dsRNA)-mediated gene silencing technology to effectively kill mosquitoes in a very specific and targeted manner without threatening other living organisms. The first mosquito species to be tested in this vector control strategy is the *Aedes aegypti* mosquito. It is the main vector for dengue, yellow fever, chikungunya and zika viruses.

People

Dr Srinivasan Ramachandran
Senior Principal Investigator

Dr Srinivasan Ramachandran obtained his PhD in Biochemistry with Plant Molecular Biology as specialisation from University of Idaho, under the guidance of Prof David Oliver. In 1993, he joined Prof Nam Hai Chua's group at the Institute of Molecular and Cell Biology, later at the Institute of Molecular Agrobiolgy, Singapore. He is heading the group of Rice Functional Genomics at Institute of Molecular Biology since 2001 and since 2002 at TLL. Concurrently since 2003 to 2008 he was heading joint lab as Principal Investigator at the Institute of Genetics and Developmental Biology, Chinese Academy of Sciences, Beijing, China. Also from 2007 to 2012, he headed another group at the Center for Bioenergy Plants, at Institute of Botany, Chinese Academy of Sciences, Beijing, China.

He has several peer reviewed publications and patents to his credit. For the past five years, he is working on *Jatropha* tissue culture technology development, molecular biology and has been taking care of the field trials in India and other regions. Since

2009, Dr Ramachandran is working as Chief Technology Officer at JOil (S) Pte. Ltd.

Also since 2014, he is an Adjunct Associate Professor at the School of Biological Sciences, Nanyang Technological University. Dr Ramachandran has also served as a member of the Genetic Modification Advisory Committee (GMAC) of Singapore.

Dr Ramachandran's research interests are:

- Rice functional genomics programme to identify abiotic stress (drought and salinity) responsive genes and develop rice plants with improved tolerance to these stresses;
- Biofuel crops research – Improving sweet sorghum plant for bioethanol production and *Jatropha* plants for bio-diesel for sustainable production;
- Improving leafy vegetables yield through ployploidy assisted breeding; and
- Control of mosquitos using plant based bio-active compounds.

Dr Cai Yu

Principal Investigator

Dr Cai Yu obtained his BSc (1993) from Xiamen University, China and PhD (2003) from the Institute of Molecular and Cell Biology, National University of Singapore, in the laboratory of Bill Chia/ Yang Xiaohang. He spent one year in the same lab as a postdoc before joining TLL as a Young Investigator in 2004. He was promoted to Principal Investigator in 2009 and is currently an adjunct assistant professor of the Department of Biological Sciences, National University of Singapore.

Dr Cai's research interests are in stem cells, which can self-renew and give rise to differentiated daughters, and are responsible for the generation of diverse cell types during development and the maintenance of tissue/ organ homeostasis in adulthood. Dr Cai's laboratory deploys two well-established systems, female germline stem cells and neural stem cells of the model organism *Drosophila melanogaster* to study stem cell biology in an entire organism (in vivo). The immediate aim is to investigate the underlying mechanisms controlling stem cell self-renewal versus differentiation during development. The long-term goal is to extrapolate our knowledge to stem cell-based therapy in regenerative medicine and cancer biology. The laboratory is currently expanding its research into the field of mosquito-related research with an aim to develop novel bio-based methods for mosquito vector control.

3. Innosparks Pte. Ltd.

Innosparks is an engineering product development and innovation company. Established in 2014, it is a Singapore-based company and a subsidiary of ST Dynamics, the advanced engineering centre of ST Engineering. Innosparks applies engineering innovation to improve everyday lives.

Proposal on Air+ Smart Mask and Micro Ventilator for Younger Children

Innosparks had successfully developed and launched the Air+ Smart Mask and Micro Ventilator for children aged seven years and above. However, a protective mask solution for children under the age of seven has yet to be developed. Hence, Innosparks intends to develop a new range of Air+ Smart Mask and Micro Ventilator specifically tailored for younger children from ages three to six years old.

Developing the Air+ Smart Mask for young children between three-six years requires a complete relook of the product. Their faces are significantly smaller, facial features less defined, their breathing shallower, and they are more sensitive to wearing facial apparel like masks. Hence, a complete redesign is necessary. The key technical challenges are to develop a new mask concept and form, miniaturise the micro ventilator and still achieve a N95-equivalent level of protection.

Proposal on Airbitat Smart Coolers for Efficient Outdoor Thermal Comfort

Innosparks has successfully developed and launched the Airbitat Smart Cooler in August 2016. The Airbitat Smart Cooler delivers powerful tangible cooling in hot and humid ambient conditions, which are typically challenging for conventional evaporative coolers. Engineered to be eco-friendly and energy-smart, the Airbitat Smart Cooler cools deeper than standard evaporative coolers, with its innovative two-stage technology to create fresh cool zones from 24°C at just 20 per cent energy usage of an air conditioner.

In hot and humid climates such as Singapore, conventional air conditioners are not suitable as they are energy intensive and generate significant waste heat. In this aspect, the Airbitat Smart Cooler meets the market gap with its deep cooling performance and energy-smart sustainable operation.

The Airbitat Smart Cooler features three new innovations:

1. **Revolutionary Deep Cooling:** Ability to reduce ambient temperature in hot and humid environments by up to 10°C i.e 3-4°C lower than standard commercial coolers. It achieves this through its innovative cold water generation system and multi-pass cooling through high performance materials.
2. **Unique Compact Design for High Performance:** The Airbitat's unique system configuration allows for it to have a small footprint while delivering high cooling capacity, outperforming equivalent products in the market. Its specially designed nozzle array also delivers a wider cooling coverage.
3. **Ultra Energy Efficient:** Delivering deep cooling through its unique system configuration while being 80% more energy efficient than air conditioning.

The Airbitat Smart Cooler is currently test-bedding at various sites including the Singapore Zoo. Increased test-bedding is planned for the Airbitat Smart Coolers to research potential capabilities for air purification and air filtration.

People

Gareth Tang

Vice President, Technology and General Manager, Innosparks

A passionate innovator and engineer, Gareth Tang leads a diverse multidisciplinary team of engineers at Innosparks to create breakthrough innovations and engineering impactful products to improve everyday lives. His keen focus on engineering for good engendered the award-winning AIR+ Smart Mask & Micro Ventilator, designed to deliver respiratory protection against airborne pollution such as the haze for children and the family; as well as the development of the revolutionary Airbitat Smart Cooler, a sustainable outdoor cooler showcased at the Singapore Zoo.

Jerome Lee

Research & Development Manager

Jerome Lee is the Product and Research & Development Manager of AIR+ Smart Mask. He oversees the operations, production, sales and logistics aspects of the mask business. He also heads the Research & Development unit to improve existing products, to innovate new product features and to launch new product pipelines, in order to deliver the best personal protective solutions to people who need them.

Li Fuyun

Research & Development Manager

Li Fuyun is the Product and Research & Development Manager of the Airbitat Smart Cooler. He oversees the engineering development of the Airbitat Smart Cooler from concept to product, as well as heading research & development to innovate new product features and product enhancements.

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