

PRESIDENT'S TECHNOLOGY AWARD 2024

Malini Olivo

Distinguished Principal Scientist
Translational Biophotonics Lab
A*STAR Skin Research Labs
Agency for Science, Technology and Research

Gurpreet Singh

CEO and Founder
Respiree Pte Ltd

Principal Scientist
Translational Biophotonics Lab
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Renzhe Bi

Principal Scientist
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Augustine Tee

Chairman,
Division of Medicine and
Senior Consultant, Department of Respiratory & Critical Care Medicine
Changi General Hospital
SingHealth

“For their innovative integration of biophotonics, machine learning and clinical data to create Respiree, a healthcare solution which has demonstrated the potential to transform cardio-respiratory disease management in real-world settings.”

Professor Malini Olivo and team are recognised for their development of a groundbreaking optical wearable technology to measure respiratory and lung physiological parameters. This innovation has the potential to revolutionise clinical decision-making across the healthcare continuum, from post-operative care and general wards to home settings.

Monitoring of respiratory rates is a routine vital sign in healthcare, but standard counting methods are laborious. Automated, reliable and continuous measurement of breathing has the potential to improve healthcare delivery. By integrating these respiratory and

lung physiology metrics, healthcare professionals can gain a more accurate and timely understanding of patient condition, improving overall care efficiency and potentially preventing fatalities.

To validate the use of the optical wearable technology, Professor Olivo's team, collaborated with Adjunct Associate Professor Augustine Tee's team at Changi General Hospital (CGH) to conduct patient trials at CGH since 2018, and translate the technology for clinical applications. This included a study for patients with respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD) and pneumonia, and a three-month trial for some 100 patients at COVID-19 isolation facilities in 2020. The same year, during the pandemic, the technology was licensed and spun-off to Respiree™ Pte Ltd to scale and commercialise the technology.

Since 2020, there have been notable commercial achievements of the solution. The optical wearable technology has received four global regulatory clearances including FDA-clearance, Therapeutics Goods Administration (TGA), Europe's CE (MDD) as well as clearance from Singapore's Health Science Authority (HSA). The optical technology has also received five international patent grants including by the US Patent Technology Office, China's Patent Office, Japan's Patent Office, EU's Patent Office and Singapore IPOS. The system is also presently enterprise-integrated into health IT systems and clinical pathway management services.

Respiree has further signed several commercial distribution agreements with large multinational companies to scale up internationally. It has also developed key clinical partnerships with academic medical centres across US and Australia namely Massachusetts General Hospital, Kaiser Permanente, and recently with Mayo Clinic under the Mayo Clinic Platform Accelerate Program as well as Alfred Health in Australia. To support these partnerships and expansion, Respiree has raised more than US\$ 7M USD in venture funding through institutionalised venture capital.

Locally, the team has solidified several strategic partnerships with hospitals in Singapore. In a paper presented at the inaugural American Thoracic Society Conference in 2022, Professor Olivo and team demonstrated that direct respiratory rate and breathing patterns could predict patient deterioration, even when traditional bedside cardiovascular indicators such as pulse oximetry appeared normal. With the National Research Foundation's Central Gap Funding, the technology's predictive AI algorithm, developed and validated in continued collaboration with Changi General Hospital to further enhance the device for improved patient outcomes, has exhibited the capacity to predict patient deterioration, providing a lead time of 18-21 hours prior to the manifestation of deterioration at a performance of 91.7%. With funding from the National Health Innovation Centre (NHIC), the optical wearable technology has also been validated at the KK's Women's and Children Hospital for clinical use beyond adults to pediatrics.

Prof Olivo has also led several first-in-human clinical studies translating biophotonics technologies to improve healthcare outcomes in skin cancer, breast cancer, vascular disease and skin inflammation. She has more than 75 patents/patent applications on

medical biophotonics technology platforms and devices in diffused-optical methods, photo-acoustic hybrid imaging, confocal Raman, surface enhanced Raman and nanophotonics optical strategies. She has published extensively with more than 500 peer reviewed publications with over 15,500 citations. In addition, she has trained over 50 PhD scientists, including team members Dr Singh and Dr Bi, who have become leaders in biophotonics research and its translation to clinical and commercial applications.