YOUNG SCIENTIST AWARD 2025

ANDY TAY KAH PING

Presidential Young Professor, Department of Biomedical Engineering,

College of Design and Engineering, National University of Singapore

"For advancing biomaterial-based therapies that modulate immune responses to improve diabetic wound healing and enhance cancer immunotherapy outcomes."

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Dr Andy Tay is a Presidential Young Professor at the National University of Singapore's (NUS) College of Design and Engineering, and a Principal Investigator in the NUS Institute for Health Innovation & Technology (iHealthtech) and the NUS Tissue Engineering Programme under the NUS Life Sciences Institute. He is leading the emerging field of immuno-engineering, where new biomaterials are designed to modulate immune cells and their tissue environments to improve recovery from diseases such as diabetic ulcers and cancer. This is significant because 830 million people worldwide suffer from diabetes. Up to 25% of them are vulnerable to severe wounds, and a lower limb is amputated every 30 seconds due to diabetic wounds that cannot heal. In addition, every year, there are 20 million new cancer cases and 10 million cancer deaths.

To improve diabetic wound healing, Dr Tay's laboratory developed a multi-pronged "4R programme" to bring about a healthy number of the right subtype of immune cells. These complementary approaches were found to accelerate wound healing in preclinical models by up to 200% compared to existing therapies. The first strategy, **Remove**, uses microneedles to clear anti-healing immune cells from deep wound tissues, breaking the vicious cycle of chronic inflammation that impedes recovery. The second, **Reprogram**, delivers anti-inflammatory proteins through microneedles to convert immune cells from anti-healing to pro-healing subtypes. The third, **Replace**, employs a magnetic hydrogel to mechanically stimulate fibroblasts and enhance collagen production and tissue regeneration, restoring a vital function impaired in diabetic wounds. The fourth, **Reimagine**, explores unconventional approaches such as using microalgae to generate oxygen, which promotes blood vessel formation and accelerates wound closure.

Another focus in Dr Tay's lab is the development of cancer immunotherapies. His lab has engineered nanostraws – hollow tubes about 10,000 times smaller than a grain of rice – to deliver proteins, RNA and DNA that genetically enhance the ability of immune T cells to detect and kill cancer cells. This technique enables efficient delivery of biomolecular cargo, making it faster and more cost-effective to generate Chimeric Antigen Receptor T (CAR-T) cells, with the goal of broadening patient access to this transformative cancer immunotherapy.

Dr Tay has distinguished himself as both a prolific scientist and a dedicated educator. Since starting his lab in 2020, he has raised more than S$ 8.5 million in research grants as the sole principal investigator, filed 7 invention disclosures, and published 32 papers as the corresponding author. His lab has trained 19 postdoctoral researchers and research assistants, 22 graduate students and 40 undergraduates. Additionally, Dr Tay actively advocates for STEM education and outreach both locally and globally, training graduate students to produce accessible science videos for the public. He is also a faculty member at NUS College where he teaches an interdisciplinary course on cell manufacturing and therapy, exploring both the scientific foundations and the socioeconomic factors necessary to broaden patients' access to advanced cell therapies.

Dr Tay has received multiple prestigious international awards for his work. Some of these accolades include the IAMBE Early Career Award (2025), Young Scientist Award in Bioelectromagnetics (2025), and Terasaki Young Innovator Award (2023). He has also been recognised as a Forbes 30 Under 30 honouree (US/Canada, Science), a World Economic Forum Young Scientist and is ranked among the world's top 2% scientists.