PRESS RELEASE

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Engineered gut bacteria improves survival outcomes in colorectal cancer tumours

Singapore, 22 September 2025 – In a new study that combines synthetic biology with cancer immunotherapy, researchers from the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine) and Central South University in China have developed an engineered strain of gut-homing bacteria that stimulates potent antitumour immune responses against colorectal cancer (CRC).

Antitumour immune responses refer to the actions taken by the body's immune system to recognise, attack, and destroy cancer cells. It operates like the body's internal surveillance system, spotting rogue cells (like tumour cells) and activating its defence forces to eliminate them.

Harnessing the immune system to fight cancer offers a powerful and precise approach to disease control. Unlike traditional treatments such as chemotherapy or radiation, which can harm healthy cells, immune responses can selectively target and destroy cancer cells with high specificity. However, many tumours develop ways to suppress or evade the immune system, creating a hostile microenvironment that works to hide them from immune attack. Enhancing antitumour immune responses helps overcome this suppression and has been linked to improved treatment outcomes and longer survival rates.

There is currently an unmet need for better treatment options for patients with advanced CRC, which is the second leading cause of cancer death worldwide, sitting at over 9% of all cancer deaths[1]. By engineering bacteria to target both tumours and trigger immune responses locally, the researchers hope to advance a new class of synbiotic therapies.

The research, published in *Science Translational Medicine*, demonstrates that a genetically modified *Salmonella typhimurium* strain can colonise tumours and release a therapeutic protein, LIGHT, to induce the formation of mature tertiary lymphoid structures (mTLSs) in

[1] Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024;74(3):229-263. doi:10.3322/caac.21834

laboratory models. These immune ‘hubs’ are associated with improved survival and stronger responses to treatment in CRC.

“This work provides compelling evidence that mTLSs can be therapeutically induced using synthetic biotics,” said Professor Shawn Chen Xiaoyuan, Nasrat Muzayyin Professor in Medicine and Technology from the Department of Diagnostic Radiology, and Director at the Nanomedicine Translational Research Programme (TRP) at NUS Medicine. “Our engineered strain stimulates a key immune signalling pathway, LIGHT-HVEM, to activate group 3 innate lymphoid cells and kickstart T cell–mediated antitumour responses.”

The bacterial therapy not only suppressed tumour growth and improved survival in the laboratory models, but also restored healthy gut microbiota and showed excellent biocompatibility. Importantly, the treatment was well tolerated in vivo, with no off-target accumulation in other organs.

“This approach could pave the way for programmable ‘living medicines’ that reshape the tumour environment from within,” added co-lead author Professor Pengfei Rong, Department of Radiology, The Third Xiangya Hospital, Central South University.

Next steps for the research team include rigorous testing and advancing toward human clinical trials to assess safety and efficacy in patients.

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Our multidisciplinary and real-world approach to education, research and entrepreneurship enables us to work closely with industry, governments, and academia to address crucial and complex issues relevant to Asia and the world. Researchers in our faculties, research centres of excellence, corporate labs and more than 30 university-level research institutes focus on themes that include energy; environmental and urban sustainability; treatment and prevention of diseases; active ageing; advanced materials; risk management and resilience of financial systems; Asian studies; and Smart Nation capabilities such as artificial intelligence, data science, operations research, and cybersecurity.

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About the NUS Yong Loo Lin School of Medicine (NUS Medicine)

The NUS Yong Loo Lin School of Medicine is Singapore's first and largest medical school. Our enduring mission centres on nurturing highly competent, values-driven, and inspired healthcare professionals to transform the practice of medicine and improve health around the world.

Through a dynamic and future-oriented five-year curriculum that is inter-disciplinary and inter-professional in nature, our students undergo a holistic learning experience that exposes them to multiple facets of healthcare and prepares them to become visionary leaders and compassionate doctors and nurses of tomorrow. Since the School's founding in 1905, more than 12,000 graduates have passed through our doors.

In our pursuit of health for all, our strategic research programmes focus on innovative, cutting-edge biomedical research with collaborators around the world to deliver high impact solutions to benefit human lives.

The School is the oldest institution of higher learning in the National University of Singapore and a founding institutional member of the National University Health System. It is one of the leading medical schools in Asia and ranks among the best in the world (Times Higher Education World University Rankings 2025 by subject and the Quacquarelli Symonds (QS) World University Rankings by subject 2025).

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About the National Medical Research Council (NMRC)

The NMRC was established in 1994 to oversee research funding from the Ministry of Health and support the development and advancement of biomedical research in Singapore, particularly in the public healthcare clusters and medical schools. NMRC engages in research strategy and planning, provides funding to support competitive research grants and core research enablers, and is responsible for the development of clinician scientists through awards and fellowships. The council's work is supported by the NMRC Office which is part of MOH Holdings Pte Ltd. Through its management of the various funding initiatives, NMRC promotes healthcare research in Singapore, for better health and economic outcomes.