

PRESS RELEASE

23 DECEMBER 2023 | FOR IMMEDIATE RELEASE

Breast cancer cells' self-sacrificial behaviour uncovered as potential cause of relapse

A study led by the NUS Yong Loo Lin School of Medicine discovered that certain breast tumour cells sacrifice their own growth to aid other cells in resisting chemotherapy

Singapore, 23 December 2023—For patients with early-stage breast cancer, there is a 7 to 11 per cent chance of relapse within five years after receiving initial treatment, and this rate can be higher for patients with more advanced stage of the cancer. While chemotherapy aims to eliminate all cancer cells, some of them may evade treatment and survive, resulting in recurrence of the cancer.

In a study that spanned over 10 years, **Research Assistant Professor Leong Sai Mun from the NUS Centre for Cancer Research (N2CR) and the Department of Pathology at the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine)** and his research team sought to uncover the reasons for why some breast cancer tumours survive chemotherapy. In examining tumour and blood samples from 63 patients with breast cancer across different stages, as well as lab-grown breast cancer cells and laboratory models, the team found that cancer cells with high expression of a certain molecule—a small non-coding RNA known as miR-125b—cooperate with surrounding cancer cells to allow the latter to grow and resist chemotherapy. Contrary to the widely held belief that cancer cells are solely self-serving and driven by their own survival, this breakthrough study confirms that they display altruistic behaviour to help other cancer cells thrive by sacrificing their own abilities to multiply. This discovery reveals that disrupting such cooperation could be key to developing more effective treatments for breast cancer.

Asst Prof Leong said, “Our research has identified these cooperative behaviours between cancer cells, which treatment must target specifically, for them to be destroyed more effectively. For example, treatment methods have to incorporate mechanisms that prevent the surrounding cancer cells from responding and benefitting from the ‘self-sacrificing’ cells.”

Published in [Molecular Cancer](#), the research paper describes the complex signalling process within these altruistic cells which results in the tumour’s overall resistance to treatment. Through a signalling pathway known as NF-κB, altruistic cancer cells showing high miR-125b expression undergo reduced proliferation. Paradoxically, this same signalling process prompts these altruistic cancer cells to release substance—proteins known as *IGFBP2* and *CCL28*—which fosters greater tolerance to chemotherapy across the entire cancer tumour.

“Removing these altruistic cancer cells can be a potential treatment strategy. However, we may have to consider the persistence of these cells. We found that despite the self-sacrifice, the altruistic cancer cells can regenerate from the non-altruistic ones and remain within the tumour population at a low yet consistent frequency,” added Dr Muhammad Sufyan Bin Masroni, first author of the study, and research fellow from the Department of Pathology at NUS Medicine.

The research team also involved collaborators from other departments of NUS Medicine; the NUS Faculty of Science; National University Hospital (NUH); Nanyang Technological University, Singapore (NTU); Singapore Institute for Clinical Sciences (SICS) and Institute of Molecular and Cell Biology (IMCB) at the Agency for Science, Technology and Research (A*STAR); MiRXES; CellSieve; Raffles Hospital; Tucker Medical; and the Pennsylvania State University, United States.

Associate Professor Mikael Hartman, Head and Senior Consultant, Division of General Surgery (Breast Surgery), Department of Surgery, NUH, and co-author of the study, said, “This research study provides important insights into the intricate biology of breast cancer, offering a promising avenue for better comprehension of its behavioural aspects, prognosis, and potential treatment targets.”

Through the study, the team demonstrated complex interactions among cancer cells which resemble social bonds observed in micro-organisms and animals, such as bees and ants. The team also showed that certain cancer pathways, which are currently recognised as separate mechanisms that either suppress or grow tumours, can take place as simultaneous events within the altruistic cancer cells, regulating the delicate balance of cooperative social behaviour within the tumour. Beyond cancer treatment, the fundamental mechanism of such altruistic behaviour has broader implications for the understanding of the interplay between social organisms in other diseases, such as those driven by bacteria or viruses.

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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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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 Asia's leading medical schools and ranks among the best in the world (Times Higher Education World University Rankings 2024 by subject and the Quacquarelli Symonds (QS) World University Rankings by subject 2023).

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