

PRESS RELEASE

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Short mitochondrial protein may help protect the ageing heart from inflammation and failure

Study led by the NUS Yong Loo Lin School of Medicine identifies STMP1 as a key guardian of heart-cell mitochondria and a potential target for treating age-related heart failure

Singapore, 1 September 2026 — Researchers from the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine) have discovered that a relatively short protein may play an important role in protecting the ageing heart. The protein, known as STMP1, is made up of 47 amino acids and helps maintain the internal structure of mitochondria, which are parts of cells that produce energy. The preclinical findings were published in [*Circulation*](#).

Heart failure is a major cause of illness and death, particularly among older people, and ageing is linked to “inflammaging”, a state of long-term, low-grade inflammation that can contribute to age-related disease. To understand how this begins in the heart, the researchers studied heart tissue and cellular data from laboratory models and humans.

They found that levels of STMP1 fell specifically in cardiomyocytes (muscle cells that enable the heart to contract) and were also lower in human hearts affected by dilated cardiomyopathy. Laboratory models which were unable to produce STMP1, developed mitochondrial damage, persistent inflammation, reduced pumping ability, enlargement of the heart’s main pumping chamber, scarring, and heart muscle cell death. Restoring STMP1 or blocking the inflammation early significantly protected heart function.

Dr Francesco Paolo Ruberto, first author of the study and research fellow at the Department of Medicine and Cardiovascular-Metabolic Disease Translational Research Programme (CVMD TRP), NUS Medicine, said, “STMP1 is an exceptionally small protein, but our findings show that it has an important role in keeping the mitochondria of heart muscle cells structurally stable. When it is lost, this can set off a chain of mitochondrial damage, inflammation, and heart failure.”

Using advanced three-dimensional electron microscopy, the researchers examined the mitochondria in detail. They found that the loss of STMP1 damaged cristae, which are folded inner membranes that support energy production. This caused mitochondrial DNA to leak into the surrounding cell. Because DNA is not normally found there, the cell mistook it for a sign of infection and activated an immune alarm known as the cGAS–STING pathway. This produced a persistent inflammatory response, disrupted the cells’ energy production, and contributed to

the death of heart muscle cells. Importantly, signs of inflammation appeared before laboratory models developed clear heart failure, suggesting that inflammation may help drive the disease.

Potential new treatment approaches

The researchers tested two ways of interrupting this process. First, they used a gene-delivery system to restore STMP1 in the heart. This improved mitochondrial structure, reduced inflammation, and restored heart function in the laboratory models.

Second, they used a drug to block STING. When given early, the treatment preserved heart function and reduced signs of inflammation, cardiac stress, and scarring in laboratory models. However, it did not restore heart function when treatment began after significant mitochondrial damage had developed.

Professor Roger Foo, Zayed bin Sultan Al Nahyan Professor in Medicine, CVMD TRP, NUS Medicine, and corresponding author of the study said, “Age-related heart decline is often seen as unavoidable wear and tear, but our study identifies a specific biological process that may be contributing to it. Targeting STMP1 or the inflammation pathway it controls could eventually help us treat an underlying cause of heart failure, rather than only its symptoms.”

The findings suggest that STMP1 could become a possible treatment target or biomarker for identifying an ageing or failing heart. However, the research remains at the preclinical stage, and further studies are needed before these approaches can be tested in patients. The researchers will next evaluate STMP1 restoration and inflammation-blocking treatments in larger and more disease-relevant models. They will also study how STMP1 supports mitochondrial structure and whether its levels could be measured to identify people at risk of heart failure earlier.

This research is supported by the Singapore Ministry of Health through the National Medical Research Council (NMRC) Office, MOH Holdings Pte Ltd under the NMRC Clinician Scientist – Individual Research Grant (MOH-001480, MOH-001226, MOH-001699, MOH-001592) and Clinician Scientist Award – Senior Investigator Category (MOH-001685), and the National Research Foundation, Singapore (NRF) under the Open Fund – Large Collaborative Grant (MOH-001325). The research is also supported by Ministry of Education M2Cardage Tier 3 funding (MOE-000333-00) and the RIE2020/RIE2025 PREVENT-HF Industry Alignment Fund Pre-Positioning Programme (IAF-PP H23J2a0033) administered by A*STAR.

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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, 30 university-level research institutes, research centres of excellence and corporate labs 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 in 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 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 2026 by subject and the Quacquarelli Symonds (QS) World University Rankings by Subject 2026).

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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.

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