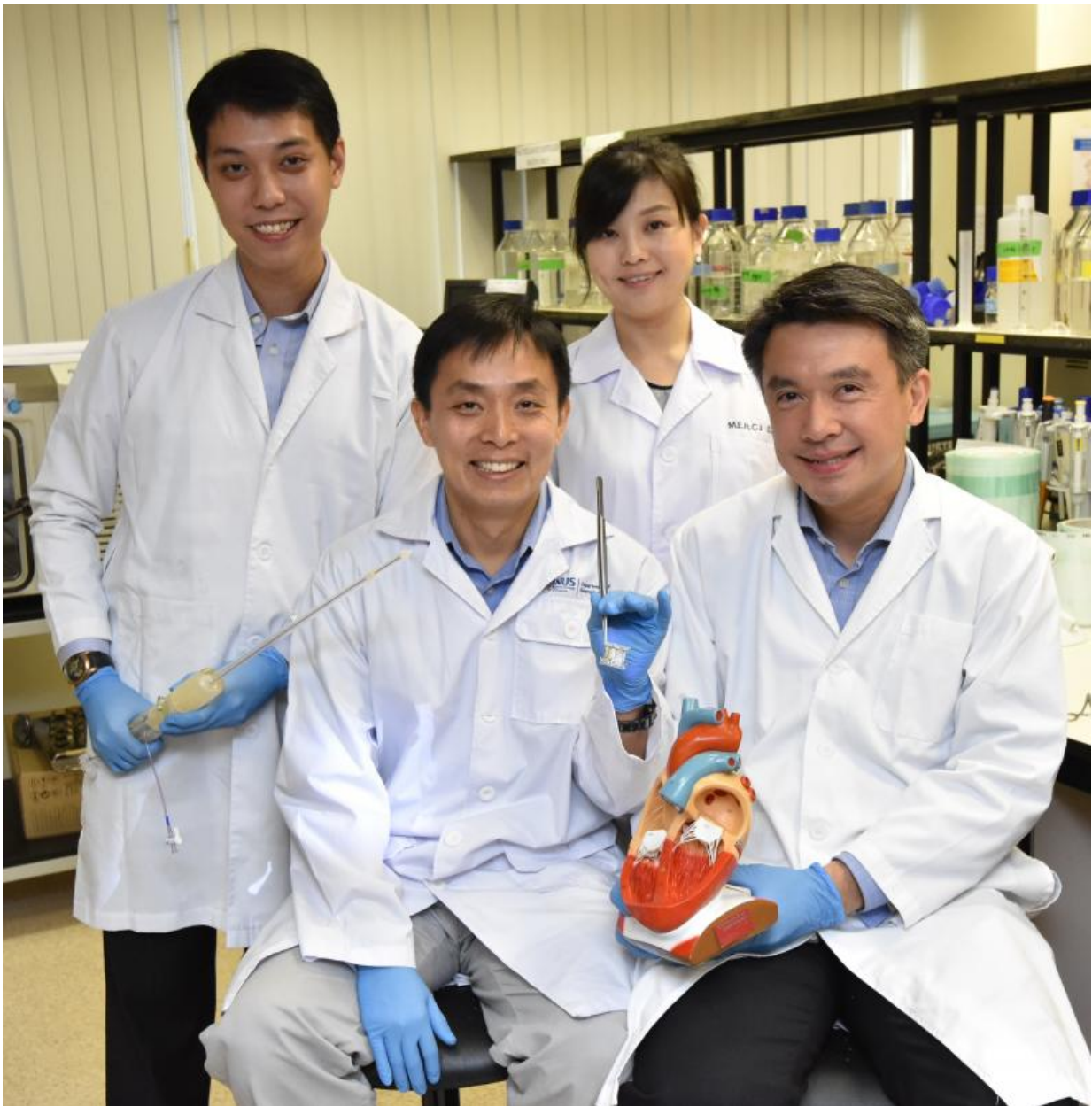


# Researchers develop novel prosthetic heart valve for treatment of severe heart disorder

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A team of researchers from the National University of Singapore has developed a novel prosthetic heart valve, known as VeloX, which can be implanted using a minimally invasive approach for treatment of a serious heart valve disorder called mitral regurgitation. Credit: National University of Singapore

A team of researchers from the National University of Singapore (NUS) has developed a novel prosthetic heart valve, known as VeloX, which can be implanted through a small incision for the treatment of a serious heart valve disorder called mitral regurgitation. This is a condition in which the mitral valve on the left side of the heart does not close properly. The device is particularly beneficial to patients who are of high surgical risk or are unsuitable for existing clinical interventions.

Heart valves are thin flaps of tissue in the [heart](#), which ensure unidirectional flow of blood between the four chambers during the cardiac cycle. The mitral valve is one of the four valves in the human heart. When the mitral valve malfunctions and does not close all the way, blood flows backward into the upper heart chamber (atrium) from the lower chamber as it contracts. This cuts down on the amount of blood that flows to the rest of the body. As a result, the heart may try to pump harder, and this may lead to [congestive heart failure](#) or it may worsen an existing heart failure.

Pioneered by Associate Professor Leo Hwa Liang from the Department of Biomedical Engineering at NUS' Faculty of Engineering, and Dr Jimmy Hon from the Department of Surgery at the NUS Yong Loo Lin School of Medicine, this novel invention addresses a clinical gap in the current treatment of mitral valve regurgitation. This research project is supported by the Medical Engineering Research & Commercialization Initiative (MERCIC) under the Department of Surgery of the NUS Yong

Loo Lin School of Medicine.

Other members of the team include Mr Kenneth Chan Zhi Wei, a current Biomedical Engineering Masters student who is working on the design of the device under the supervision of Assoc Prof Leo, and Dr Elynn Phang Hui Qun of MERCI, who is managing the commercialisation of the invention.

## **Novel invention addresses a clinical gap in treatment**

Some 12 million people suffer from mitral regurgitation worldwide, with nearly 250,000 new patients diagnosed annually. Left untreated, one in three patients with severe form of the condition will die within six years.

The standard treatment for severe [mitral valve regurgitation](#) is open-heart surgery whereby the diseased valve is replaced or repaired. However, many patients who are elderly or are suffering from multiple chronic diseases are not suitable for the treatment. Although current mitral valve interventions delivered via a small incision through the skin could be a viable alternative treatment, this strategy benefits only a highly selective group of patients who have mitral valve leaflets (which are flaps that seal the valve) of a particular shape.

VeloX addresses the clinical gap in the treatment of the condition as it can be designed to suit different mitral annulus (a saddle-shape structure that supports the leaflets of the mitral valve) sizes of patients and implanted using a minimally invasive approach. This device could therefore be a viable option for patients who are not suitable for surgeries or the standard treatment.

## **How VeloX works**

The tiny device comprises a prosthetic heart valve made of pericardial tissue "stitched" within a self-expanding, polymer coated nickel-titanium (nitinol) alloy stent frame specially designed to prevent leakage.

To implant the device, the prosthetic valve is compressed to the thickness of a pencil and loaded into a catheter. The catheter is inserted into the patient through a small incision made either at the leg or between the ribs to deliver the device straight into the left heart. The catheter will then be used to send the device to the patient's diseased [mitral valve](#). To facilitate accurate placement, the device is designed to be retrievable and repositionable.

Assoc Prof Leo explained, "The mitral annulus has a very complex structure, so it is particularly challenging to deploy and anchor a prosthetic valve into the constricted region. Optimal positioning is crucial as any malpositioning can be detrimental for patients. One of the unique features of VeloX is its ability to be self-centring, hence enabling it to achieve an optimal position after being implanted."

Dr Hon added, "VeloX will restore the unidirectional flow of the blood in the left heart and help alleviate the symptoms associated with [mitral regurgitation](#). This transcatheter valve offers palliative treatment for the patients who were denied surgery, especially those with multiple co-morbidities." Dr Hon is also a Senior Consultant at the Department of Cardiac, Thoracic and Vascular Surgery, National University Heart Centre, Singapore.

## **Further studies and commercialisation**

Building on the encouraging results from the earlier phases of the project, the team is now refining the design of the existing device. The team plans to conduct in vivo studies to acquire data on the technical performance of the device.

The researchers have filed a patent for the device, and are planning to set up a spin-off company. They hope to work with medical technology companies to commercialise their invention to benefit [patients](#) soon.

Provided by National University of Singapore

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