Innovative coating for blood vessels reduces rejection of transplanted organs

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"We're hopeful that this breakthrough will one day improve quality of life for transplant patients and improve the lifespan of transplanted organs," said Dr. Kizhakkedathu.

The findings were published today in *Nature Biomedical Engineering*.

The discovery has the potential to eliminate the need for drugs—typically with serious side effects—on which transplant recipients rely to prevent their immune systems from attacking a new organ as a foreign object.

Dr. Kizhakkedathu explained how that problem arises: "Blood vessels in our organs are protected with a coating of special types of sugars that suppress the immune system's reaction, but in the process of procuring organs for transplantation, these sugars are damaged and no longer able to transmit their message."

Researchers have found a way to reduce organ rejection following a transplant by using a special polymer to coat blood vessels on the organ to be transplanted.

The polymer, developed by UBC medicine professor Dr. Jayachandran Kizhakkedathu and his team at the Centre for Blood Research and Life Sciences Institute, substantially diminished rejection of transplants in mice when tested by collaborators at SFU and Northwestern University.

Dr. Erika Siren (left) and Dr. Jayachandran Kizhakkedathu in the lab at UBC's Centre for Blood Research. Credit: Paul Joseph/UBC

Dr. Kizhakkedathu's team synthesized a polymer to mimic these sugars and developed a chemical process for applying it to the blood vessels. He
worked with UBC chemistry professor Dr. Stephen
Withers and the study's co-lead authors, Ph.D.
candidate Daniel Luo and recent chemistry Ph.D.
Dr. Erika Siren.

Dr. Siren's thinking on cell-surface engineering had
been inspired by a visit to a BC Transplant facility.

"I remember seeing an organ sitting in a solution
and thinking, 'Here's a perfect window to engineer
something right,'" Dr. Siren recalled. "There aren't a
lot of situations where you've got this beautiful four-
hour window where the organ is outside the body,
and you can directly engineer it for therapeutic
benefit."

The work of Simon Fraser University's Dr. Jonathan
Choy and Winnie Enns confirmed that a mouse
artery, coated in this way and then transplanted,
would exhibit strong, long-term resistance to
inflammation and rejection. Dr. Caigan Du of UBC
and Dr. Jenny Zhang of Northwestern University
then got similar results from a kidney transplant
between mice. Dr. Megan Levings of UBC and the
BC Children's Hospital Research Institute firmed up
the findings using new-generation immune cells.

"We were amazed by the ability of this new
technology to prevent rejection in our studies," said
Dr. Choy, professor of molecular biology and
biochemistry at SFU. "To be honest, the level of
protection was unexpected."

The procedure has been applied only to blood
vessels and kidneys in mice so far. Clinical trials in
humans could still be several years away. Still, the
researchers are optimistic it could work equally well
on lungs, hearts and other organs, which would be
great news for prospective recipients of donated
organs.

In 2019, more than 3,000 Canadians underwent
organ transplantation with the aim of averting end-
stage organ failure.

**More information:** Prevention of vascular-
allograft rejection by protecting the endothelial
glycocalyx with immunosuppressive polymers,
*Nature Biomedical Engineering* (2021). [DOI:
10.1038/s41551-021-00777-y](https://www.nature.com/articles/s41551-021-00777-y)

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