

Genomics helps researchers identify critical genes that promote recovery of a failing heart

MEGAN IVERS, a freshman at the University of Minnesota, called her parents in Marshall, Minnesota during her final exams to tell them that she wasn't feeling well. They thought that she was just having a hard time getting over the flu. She had always been healthy and they had no reason to suspect this was anything unusual. But a 1 a.m. call from the Fairview-University Medical Center emergency room changed their lives forever. The flu Megan was suffering from had traveled into her heart, something that happens to only one of every million persons suffering from the flu. Her heart was quickly shutting down and the surgeons needed to act immediately if there was to be any hope of saving Megan.

There was not a donor heart available to transplant into Megan at the time of her heart failure, so the transplant team, led by Leslie Miller, M.D., and Soon Park, M.D., cardiologists at the University of Minnesota, decided to implant a left ventricle assist device (LVAD) into Megan's chest. This five-pound mechanical pump is implanted into the patient's chest to aid the heart in pumping. It serves as a bridge to transplant for patients waiting for donor hearts. This already risky procedure was even more precarious for Megan because, at 110 pounds, Megan is the smallest person to receive an LVAD implant. However, five percent of people with the LVAD recover completely and never need a heart transplant, and with Megan's good health and no history of heart disease, she had a good chance of a complete recovery with the LVAD. So, rather than being a bridge to a heart transplant, an LVAD could help Megan transition to recovery.

The medical team was right. Within six weeks Megan's heart showed signs of recovery, which was an incredible clinical accomplishment, given the expected recovery period of at least 18 months. Megan's LVAD was taken out less than four months after it had been implanted. She now has her healthy heart back, but Megan's story doesn't end there.

When an LVAD is implanted, surgeons remove a tiny piece of the heart. Megan and her family allowed her surgeons to remove a second microscopic piece of her heart when the LVAD was removed. These minute heart samples allow scientists to look at the expression of over 22,000 genes, and could change the way medical experts study and treat heart disease.

“By comparing gene expression changes that took place in Megan's heart to changes in patients that do not recover from an LVAD implant, we hope to identify critical genes that promote recovery of a failing heart — something we once thought impossible to do.”

— Jennifer Hall, Ph.D., University of Minnesota Medical School

Jennifer Hall, Ph.D., a basic scientist at the University of Minnesota, along with Miller and a group of researchers are examining Megan's heart tissue and tissue from other patients who recovered completely from an LVAD. Megan Ivers represents the small percentage of patients who recover enough heart function to allow the LVAD to be removed. Comparing genes expressed in a failing heart at the time of the LVAD implant with the genes expressed in the recovered heart can help researchers discover which genes are critical in telling the heart to repair itself. Researchers can also compare gene expression changes that took place in Megan's heart to changes in patients that do not recover from an LVAD implant. In these studies, University of Minnesota researchers hope to identify critical genes that promote recovery of a failing heart — something once thought to be impossible.

Megan Ivers' incredible experience with the flu may benefit millions of people suffering from heart disease around the world. Megan is finishing her sophomore year at the University of

Minnesota. She is active in the marching and concert bands. She plans to be a band instructor like her father. Megan does not feel this experience has slowed her down. “Life is a little more precious now, but I have no restrictions.”

The *Minnesota Partnership for Biotechnology and Medical Genomics* is a Minnesota initiative leveraging the scientific leadership of the University of Minnesota and Mayo Clinic into a powerful research collaboration.

For more information visit:
www.MayoUMinnesotaPartnership.org