PRESS RELEASE

Central Hub for Heart Repair Discovered

Bonn study: Heart muscle interaction enables cardiac regeneration in the neonatal heart

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Bonn, August 17 – Researchers at the University Hospital of Bonn (UKB) and the University of Bonn have identified a previously unknown signaling pathway in the immune system that helps newborn heart cells survive and regenerate after injury. The findings could open new avenues for future therapies aimed at repairing damaged adult hearts after heart attacks or chronic cardiovascular disease. The study has now been published in the journal *Cell Communication and Signaling (Springer Nature)*.

Unlike adult hearts, the hearts of newborn mammals can temporarily regenerate after damage. However, this remarkable ability is rapidly lost within the first days of life. In the new study, scientists investigated how neonatal hearts respond both to heart injury and to pressure overload, a condition that mimics chronic stress on the heart.

Immune cells communicate via signaling pathways that function like a chain of dominoes. In this process, signaling molecules trigger the next signal until a reaction is initiated. In a neonatal mouse model, the research team discovered that three immune-related signaling molecules — CCL4, S100A8, and C1QA — work together to activate a receptor called TLR2 on heart muscle cells. Activation of this pathway stimulated heart cell proliferation, enhanced survival of heart muscle cells, and reduced cell death.

“Our findings reveal an unexpected communication axis between immune signals and heart muscle cells that supports regeneration in the neonatal heart,” said corresponding author Dr. Mona Malek Mohammadi, head of a research group at the Institute of Physiology I at the UKB and the University of Bonn. “We were particularly surprised to find that TLR2 acts as a central hub connecting inflammatory signals to regenerative responses.”

No signaling pathway—no heart repair

To validate the importance of TLR2, the researchers used genetically modified mice lacking the receptor. These mice were unable to adapt to cardiac stress and rapidly developed heart failure. “This shows that TLR2 is essential for maintaining protective and regenerative responses in the neonatal heart,” says the first author Julia Nicke.

Importantly, the study also showed that TLR2 expression is much higher in newborn heart cells than in adult heart cells, suggesting that loss of this signaling pathway may contribute to the poor regenerative capacity of the adult heart.

The researchers believe these findings may eventually help scientists develop therapies that reactivate neonatal-like repair mechanisms in adult hearts after myocardial infarction or heart failure. “Current cardiovascular therapies mainly slow disease progression,” said ~~Dr.~~ Malek Mohammadi. “Our long-term goal is to promote true cardiac repair and regeneration.”

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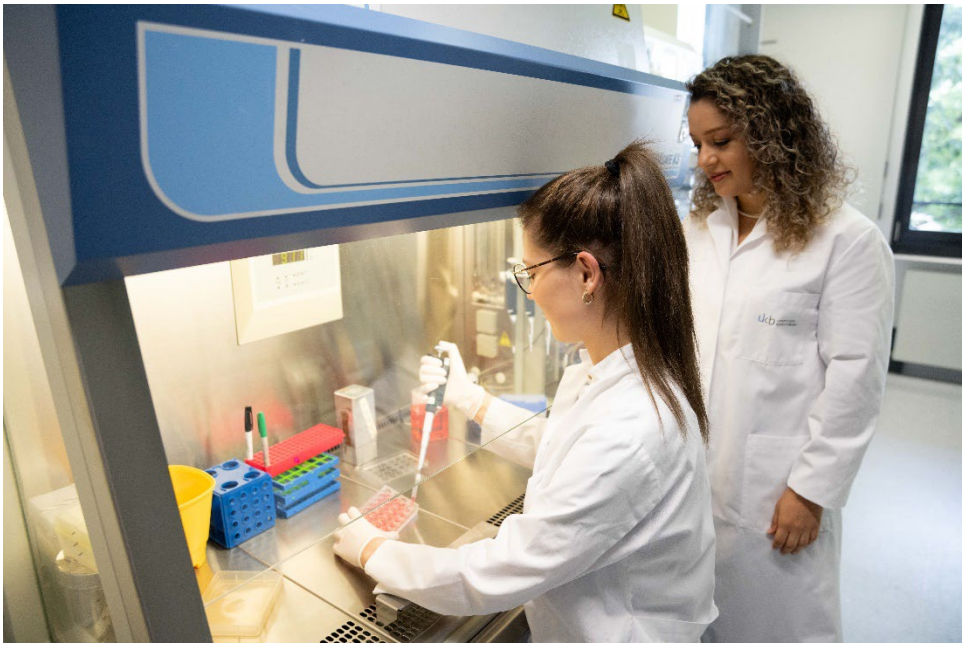

Caption: (from left) Julia Nicke and Dr. Mona Malek Mohammadi have identified a previously unknown signaling pathway in the immune system that helps newborn heart cells survive and regenerate after injury.

Picture credits: University Hospital Bonn (UKB) / Alessandro Winkler

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About the University Hospital Bonn: As one of Germany's leading university hospitals, Bonn University Hospital (UKB) combines excellence in medical care and research with high-quality teaching. Every year, UKB treats more than half a million outpatients and inpatients. Around 3,500 students are enrolled in medicine and dentistry, and over 600 individuals receive training in healthcare professions annually. With around 9,900 employees, UKB is the third-largest employer in the Bonn/Rhein-Sieg region. In the „*Focus* hospital rankings", UKB is rated the top university hospital in North Rhine-Westphalia and has the second-highest case mix index (an indicator of treatment complexity) of all university hospitals nationwide. In 2025, UKB secured nearly €100 million in third-party funding for research, transfer, and teaching. For the fourth consecutive year, the F.A.Z. Institute recognized UKB as both "Germany's Training Champion" and "Germany's Most Desirable Employer." For current figures and further information, please refer to the annual report at: geschaeftsbericht.ukbonn.de