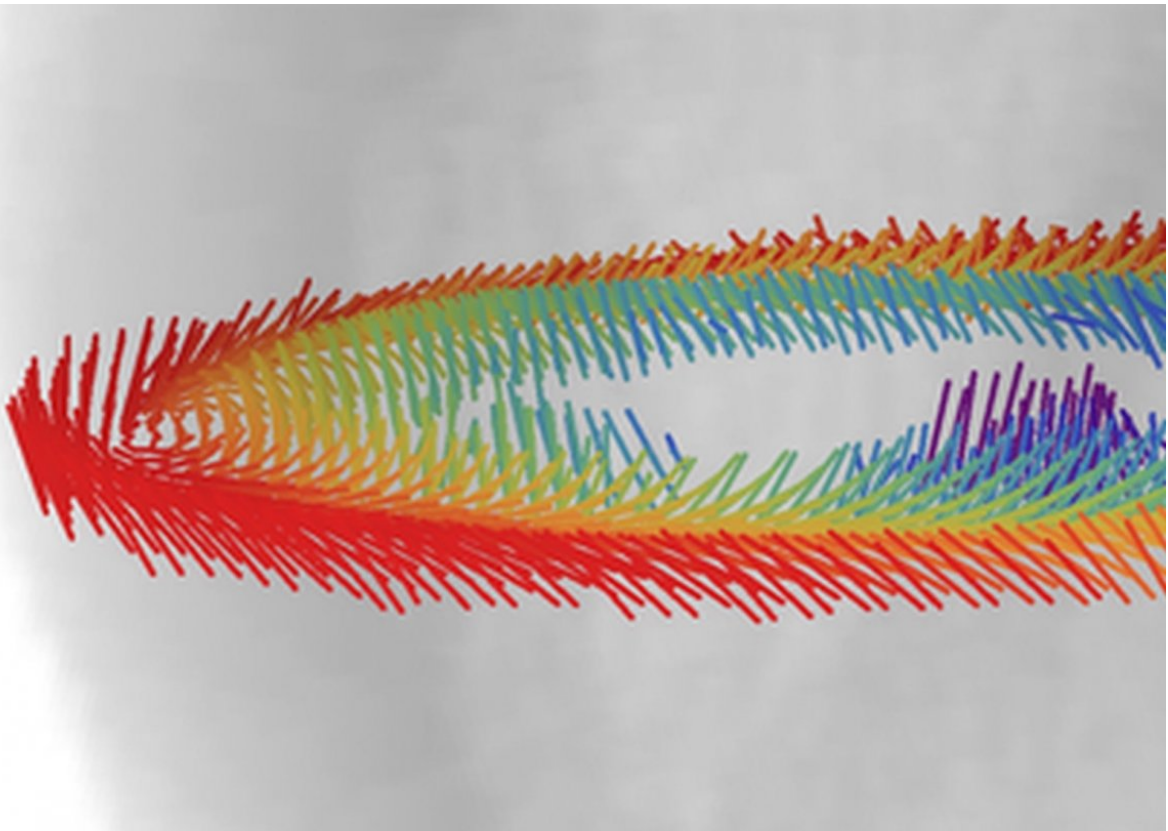


How heart tissue combines mechanical strength and electrical reliability

May 11 2018, by Chris Chipello



The helicoidal orientation of fibres in a ventricle wall is shown in bright colours, based on diffusion magnetic resonance imaging of a rat's heart tissue. Credit: Shape Analysis Group/McGill University

The human heart can be viewed as both a mechanical and an electrical

device – one that contracts and pumps billions of times over an average lifespan. How does it manage to achieve this feat without lapsing into dangerous irregularities?

New research by McGill University scientists finds that the answer lies in the particular geometry of the [muscle fibres](#) of the heart wall. A collaboration led by McGill Professor Kaleem Siddiqi had shown in a 2012 study that bundles of [heart muscle cells](#) bend and twist together in a geometrical pattern known as a "generalized helicoid" – an arrangement known to provide mechanical strength in biological materials such as insect cuticle.

In a new paper, published May 8 in the journal *Scientific Reports*, Siddiqi and his students from McGill's School of Computer Science and the Centre for Intelligent Machines used mathematical modeling and analysis to demonstrate that this arrangement of fibres also helps heart tissue conduct electrical signals reliably. The lead author of the article, Tristan Aumentado-Armstrong, was a McGill undergraduate at the time the research was carried out. "Cardiac tissue is unique in that mechanical resilience must coexist with active contraction and signal propagation," Siddiqi says. "Our analysis shows that nature has used helicoidal geometry to satisfy both the electrical and mechanical requirements of the heart."

More information: Tristan Aumentado-Armstrong et al. Conduction in the Heart Wall: Helicoidal Fibers Minimize Diffusion Bias, *Scientific Reports* (2018). [DOI: 10.1038/s41598-018-25334-7](https://doi.org/10.1038/s41598-018-25334-7)

Provided by McGill University

Citation: How heart tissue combines mechanical strength and electrical reliability (2018, May 11)

retrieved 25 April 2024 from

<https://medicalxpress.com/news/2018-05-heart-tissue-combines-mechanical-strength.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.