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Primate Model and Magnesium Clock Mechanism for Cardiac Pacemaker Research and Arrhythmia Drug Discovery

Researchers at Stanford have created the first small primate model to study human heart rhythm disorders and also discovered a new way the heart keeps its beat.

Heart rhythm disorders, including atrial fibrillation and Sick Sinus Syndrome (SSS), a condition causing abnormally slow or irregular heartbeat, affect millions of people worldwide. A major barrier to developing better treatments has been the lack of good animal models as scientists usually study these conditions in mice, whose hearts work very differently from human hearts.

Stanford researchers addressed this gap by turning to the gray mouse lemur, a small primate whose heart function closely mirrors that of humans. When they studied these animals, they found several naturally occurring heart rhythm problems similar to those seen in people. By following one inherited condition in lemur families, the researchers identified a gene that helps control heart rate. This gene moves magnesium, a mineral important for many body functions, inside heart cells. Together, these findings open new opportunities for drug discovery, disease modeling, and diagnostic development targeting hereditary heart rhythm disorders.

Stage of Development: Proof of Concept — in vitro and in vivo

Applications

- Primate disease model platform for identifying and screening cardiac arrhythmia therapeutics
- Gene knockout cells for drug discovery targeting heart rate disorders

- Genetic diagnostic tools for identifying gene mutations in patients with unexplained hereditary arrhythmias

Advantages

- First primate model to naturally develop human-like cardiac arrhythmias
- A new class of therapeutic targets from the magnesium-based pacemaker mechanism
- Human stem cell-derived knockout cells offer a more clinically relevant platform than existing rodent models.

Publications

- Stephen Chang, Caitlin J. Karanewsky, Jozeph L. Pendleton, Lu Ren, Aude Anzeraey, Victor Froelicher, David Liang, Andriamahery Razafindrakoto, Hajanirina Noëline Ravelonjanahary, Megan A. Albertelli, Thomas Quertermous, Patricia C. Wright, Martine Perret, Jérémy Terrien, Fabienne Aujard, Joseph C. Wu, Mark A. Krasnow (2025). "A primate model organism for cardiac arrhythmias identifies a magnesium transporter in pacemaker function". *bioRxiv* 2025.05.28.655959.

Patents

- Published Application: WO2026236202

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