

Engineered stem cells automatically deliver arthritis drugs at prescribed times of day

New Chronotherapy Research Could Eliminate Daily Injections for People with Rheumatoid or Juvenile Arthritis

ST. LOUIS, MO, UNITED STATES, March 6, 2025 /EINPresswire.com/ -- With nearly 1.5 million

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*Shriners Children's St. Louis
Director of Research Dr.
Farshid Guilak*

people suffering from rheumatoid and juvenile arthritis in the United States, researchers at [Shriners Children's St. Louis](#) have discovered a new revolutionary way to potentially minimize flare-ups and symptoms while preventing the progression of the disease. Shriners Children's St. Louis Director of Research Dr. Farshid Guilak recently published findings on a revolutionary new method of “chronotherapy,” the administration of drugs based on the body's circadian rhythm, potentially changing the way the condition is treated in the future.

Circadian rhythm refers to the body's 24-hour clock which is regulated by the brain and responds to light. Using a

combination of synthetic biology and tissue engineering, Dr. Guilak's research team developed circadian-based gene circuits, termed “chronogenetics,” that can be programmed into stem cells that, once implanted in the body, align with a patient's natural circadian rhythm and deliver anti-inflammatory drugs on a daily basis at a prescribed time. Certain arthritis drugs need to be injected daily to be effective, which is particularly difficult for children to endure.

“This is the first time that the cell's internal clock has been used for controlling drug delivery,” said Dr. Lara Pferdehirt, first author of the study.

While the laboratory has previously developed self-regulating “smart” cells that produce drugs in response to inflammation, this new approach was used to create stem cells that automatically make drugs based on the body's daily rhythm.

“Every cell in our body is on a 24-hour cycle, including cells that can carry flares of inflammation that often accompany conditions like rheumatoid and juvenile arthritis,” said Guilak. “Patients who have arthritis pain often experience their peak symptoms and inflammation in the early

mornings, around 3 a.m. to 5 a.m., a time when people do not normally take medication. To address this, we've created a new field called chronogenetics, bioengineered stem cells that automatically release the drugs timed to your own body to treat disease flares even before they happen."

Dr. Guilak said his team's research has shown that timing the application of medicine to line up with the body's circadian rhythm can not only help relieve pain but, in some cases, change the course of the disease. He said the findings could eventually be utilized to treat other health conditions, such as cancer or diabetes, which also show circadian characteristics.

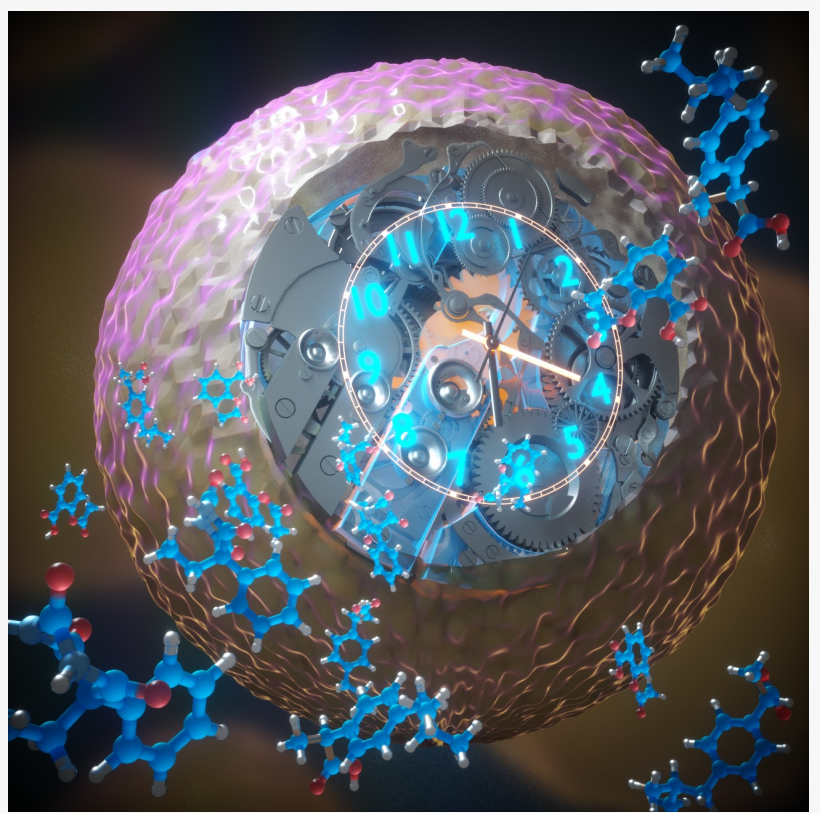
"For diseases like rheumatoid arthritis, the sooner you diagnose and treat the condition, the more you can prevent inflammation that damages the joints," said Dr. Guilak. "If the body can receive medication ahead of those flare-ups that therefore prevents joint damage, then the disease won't progress. Juvenile arthritis and RA can be very painful and symptoms can feel very debilitating, especially for children so we're hopeful that this new research can help reduce symptoms. This technology has the potential to change a lot of lives. There are no drugs that currently reverse the course of a disease, but we're hopeful this could do that."

Dr. Guilak is also the Mildred B. Simon Professor of Orthopedic Surgery and Biomedical Engineering at Washington University in St. Louis and co-Director of the Washington University Center of Regenerative Medicine. His team is working with the Food and Drug Administration (FDA) to head into clinical trials in the next 3-5 years.

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Lara Pferdehirt, Anna R. Damato, Kristin L. Lenz, Maria F. Gonzalez-Aponte, Daniel Palmer, Qing-Jun Meng, Erik D. Herzog, & Farshid Guilak. A synthetic chronogenetic gene circuit for programmed circadian drug delivery. *Proceedings of the National Academy of Sciences USA*, 16(1):1457, 2025. DOI: 10.1038/s41467-025-56584-5.

About Shriners Children's



An image of a clock within a cell represents chronogenetics. Artwork by Ella Maru Studio.

Shriners Children's improves the lives of children by providing pediatric specialty care, conducting innovative research, and offering outstanding education programs for medical professionals. Children with orthopedic conditions, burns, spinal cord injuries, and cleft lip and palate are eligible for care, regardless of the families' ability to pay, and receive all care and services in a compassionate, family-centered environment. For more information, please visit shrinerschildrens.org.

Jessica Williams
BAM Marketing Agency
+1 618-772-2349

[email us here](#)

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