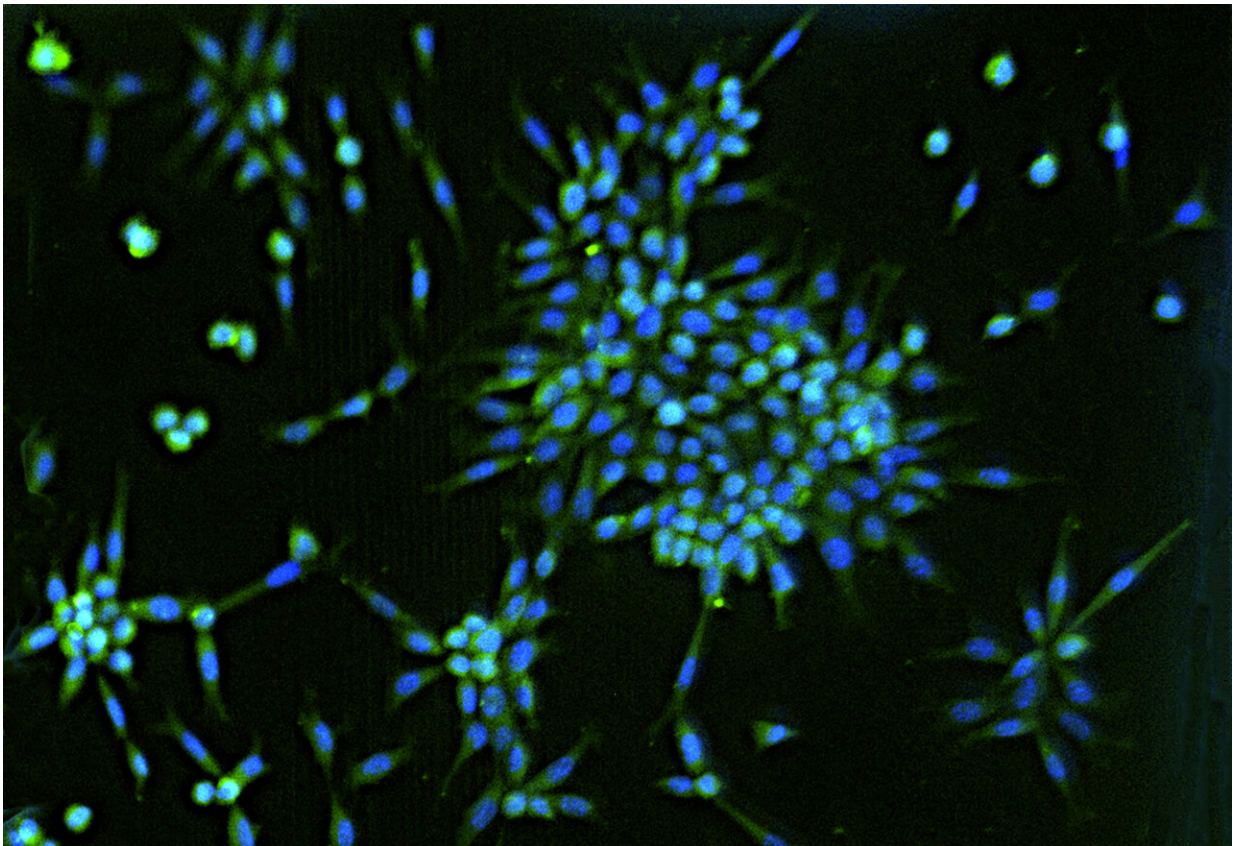


Disc-on-a-chip technology promises new strides in back pain research

May 30 2023



An image of cells on a disc-on-a-chip modelling a healthy intervertebral disc.
Credit: *Trends in Biotechnology* (2023). DOI: 10.1016/j.tibtech.2023.04.009

It's the leading cause of disability worldwide and the third most expensive health condition across the globe yet there still is no treatment

for lower back pain that goes beyond relieving its symptoms, with all of the downsides of pain medication and surgical interventions that entails.

One of the main causes of [lower back pain](#) is degeneration of the intervertebral disc—the cushion of cartilage between the vertebrae—that is a common consequence of aging, structural defects and injury.

There's been no real progress in efforts to reverse intervertebral disc degeneration or to engineer replacement tissue, but now [biomedical engineers](#) at the University of Technology Sydney (UTS) have unveiled what they call an intervertebral disc-on-a-chip, a "precision engineered toolbox for low back pain studies."

"In a situation where no solution to root causes has been forthcoming and 60 percent of surgery for back issues has to be revised, researchers have long needed a platform to accurately simulate both healthy and diseased intervertebral discs," said Chancellor's Research Fellow Dr. Javad Tavakoli.

"We are the first in the world to develop a physiologically and clinically relevant in vitro model to provide an accurate, controlled environment for lower back pain research," said Dr. Tavakoli, who with UTS Professor of Biomedical Engineering Joanne Tipper has developed the disc-on-a-chip, in collaboration with clinicians and cell specialists.

"The composition and structure of the human intervertebral disc is remarkably complex," Professor Tipper said. "At its core is a gel-like nucleus surrounded by concentric layers of collagen fibers forming three regions that together support both the spine's flexibility and its load-bearing strength."

"This complexity has been a barrier to developing an in vitro intervertebral disc model that can replicate the complex mechanobiology

of native tissue and effectively evaluate experimental methods for treatment or regeneration."

"By the same token the use of animal models has not been able to provide physiologically and clinically relevant results owing to the different size, mechanics and biology of the human intervertebral disc."

The disc-on-a-chip is a high-resolution 3D-printed microfluidic device with three channels allowing the accurate simulation of the different regions within a natural disc and even the personalization of the model to an individual.

"The disc-on-a-chip can be used to replicate the degeneration of a healthy disc or alternatively be set up as a degenerated disc to test the efficacy of new pharmaceuticals or cell therapy," Dr. Tavakoli said.

"Our chip enables performing cost-and time-effective lab experiments with the potential to enhance the physiological relevance of experimental data leading to successful clinical outcomes. It also offers the opportunity to reduce the need for animal use in the lab."

The discovery has already attracted attention, winning two awards: the AO Spine 2022 Discovery and Innovation Award and the 2022 David Findlay Early Career Research Award of the Australian and New Zealand Orthopaedic Research Society.

The development of the intervertebral disc-on-a-chip is covered in more detail in a recent paper in the journal *Trends in Biotechnology*, titled "Intervertebral disc-on-a-[chip](#): a precision engineered toolbox for low back pain studies."

More information: Javad Tavakoli et al, Intervertebral disc-on-a-chip: a precision engineered toolbox for low back pain studies, *Trends in*

Biotechnology (2023). [DOI: 10.1016/j.tibtech.2023.04.009](https://doi.org/10.1016/j.tibtech.2023.04.009)

Provided by University of Technology, Sydney

Citation: Disc-on-a-chip technology promises new strides in back pain research (2023, May 30)
retrieved 25 April 2024 from

<https://medicalxpress.com/news/2023-05-disc-on-a-chip-technology-pain.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.