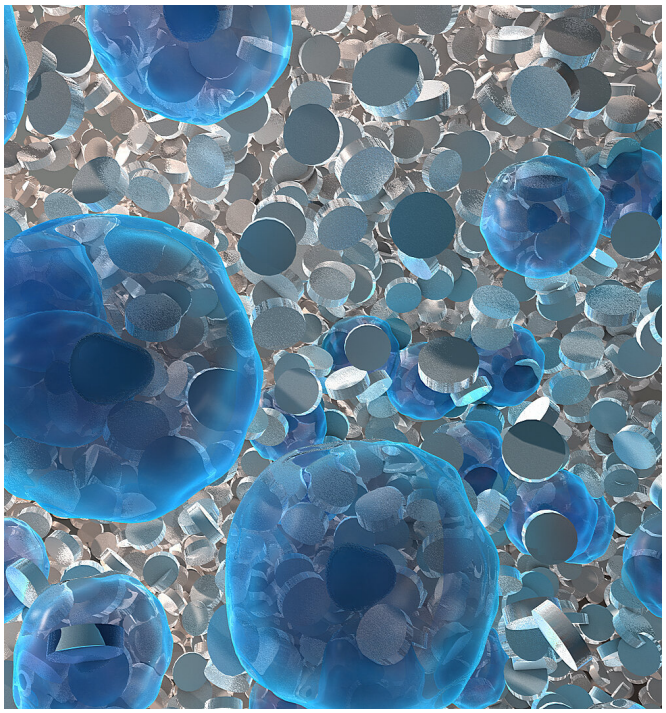
Researchers develop new therapeutic approach to treating osteoarthritis

19 February 2019



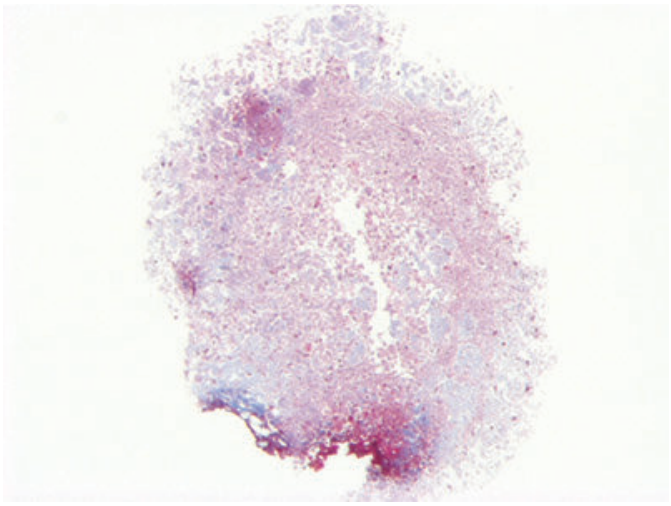
Two-dimensional nanoparticles interacting with stem cells and directing differentiation toward cartilage-lineage. Credit: Texas A&M University College of Engineering

Researchers from Texas A&M University, led by Dr. Akhilesh K. Gaharwar, have developed a new way to deliver treatment for cartilage regeneration.

Gaharwar, assistant professor in the Department of Biomedical Engineering at Texas A&M, said the nanoclay-based platform for sustained and prolonged delivery of protein therapeutics has the potential to impact treating osteoarthritis, a degenerative disease that affects nearly 27 million Americans and is caused by breakdown of cartilage that can lead to damage of the underlying bone.

As America's population ages, the number of osteoarthritis incidences is likely to increase. One of the greatest challenges with treating osteoarthritis and subsequent joint damage is repairing the damaged tissue, especially as cartilage tissue is difficult to regenerate.

One method for repair or regeneration of damaged cartilage tissue is to deliver therapeutic growth factors. Growth factors are a special class of proteins that can aid in tissue repair and regeneration. However, current versions of growth factors break down quickly and require a high dose to achieve a therapeutic potential. Recent clinical studies have demonstrated significant adverse effects to this kind of treatment, including uncontrolled tissue formation and inflammation.



The formation of cartilage-related proteins (red color), when human stem cells are treated with growth factor loaded nanoparticles. Credit: Texas A&M University College of Engineering

In Texas A&M's study, published in *ACS Applied Materials and Interfaces*, Gaharwar's lab has designed two-dimensional (2-D) mineral

nanoparticles to deliver growth factors for a prolonged duration to overcome this drawback. These nanoparticles provide a high surface area and dual charged characteristics that allow for easy electrostatic attachment of growth factors.

"These nanoparticles could prolong delivery of growth factors to human mesenchymal stem cells, which are commonly utilized in cartilage regeneration," Gaharwar said. "The sustained delivery of growth factors resulted in enhanced stem cell differentiation towards cartilage lineage and can be used for treatment of osteoarthritis."

"By utilizing the nanoparticle for therapeutic delivery it is possible to induce robust and stable differentiation of stem cells," said Dr. Lauren M. Cross, senior author of the study and research assistant in the biomedical engineering department. "In addition, prolonged delivery of the growth factor could reduce overall costs by reducing growth factor concentration as well as minimizing the negative side effects."

More information: Lauren M. Cross et al, Sustained and Prolonged Delivery of Protein Therapeutics from Two-Dimensional Nanosilicates, *ACS Applied Materials & Interfaces* (2019). DOI: 10.1021/acsami.8b17733

Provided by Texas A&M University