



STARSTEM | SHEDDING NEW LIGHT ON REGENERATIVE MEDICINE

STARSTEM is devoted to understanding how stem cells and exosomes lead to healing. Understanding the hallmarks of the healing process will help researchers and doctors to treat osteoarthritis and a wide range of human diseases.



Managing osteoarthritis

Osteoarthritis is the most common form of arthritis, which is caused by the wear and tear of cartilage in the joints over time. The breakdown of this protective cartilage means that the surface of joints become damaged and the surrounding bone grows thicker. Osteoarthritis affects around 10% of the global population, and around 70 million patients in Europe. There is no effective cure for osteoarthritis at present, and the majority of treatments tackle the symptoms rather than treating the disease itself.



Nanotechnology and imaging

Photo-acoustic (PA) imaging is a non-invasive process which enables scientists to use laser light to build images of tissue and other substances under the skin. In STARSTEM, we use nanostars to enhance this effect. These gold star-shaped nanoparticles act as a contrast medium for PA imaging by increasing the thermal response at the site. We also use Magnetic Resonance Imaging (MRI) to track labelled cells and regeneration. Nanostars will be attached to stem cells and exosomes. These tagged targets can be detected in very small amounts and at greater depths in order to track their distribution, engraftment, and activity over time.



Regenerative medicine

Regenerative medicine is a branch of medicine dedicated to developing methods which can repair or replace cell, organ, and tissue function that has been lost. This could be due to age, disease, damage, or congenital defects. In STARSTEM, we use mesenchymal stem cells (MSCs) and exosomes (extracellular vesicles) to create cell therapies. MSCs are a type of cell which can be isolated from the mix of cells which comprise the bone marrow. Exosomes are tiny sub-cellular vesicles within the MSCs. MSCs and exosomes are thought to help trigger healing and support tissue repair in the body. STARSTEM's therapeutic approach may help protect against degradation but might also help to repair damaged cartilage.



Path to clinical trial

STARSTEM will help scientists and clinicians to understand how stem cells actually work. A key question for regenerative medicine is the nature of the therapeutic agent – do stem cells lead to healing directly, or do they communicate with the body to trigger healing at a distance? This means looking at where they go and how quickly they get there and looking at how healing occurs over time. Cells that are tagged with nanostars will be administered for *in vitro* and *in vivo* imaging in models of arthritis. The next step for nanostars is to pass through the clinical trial process. After the project is completed, we will run this trial to examine nanostars with labelled cells in action.

The STARSTEM team



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