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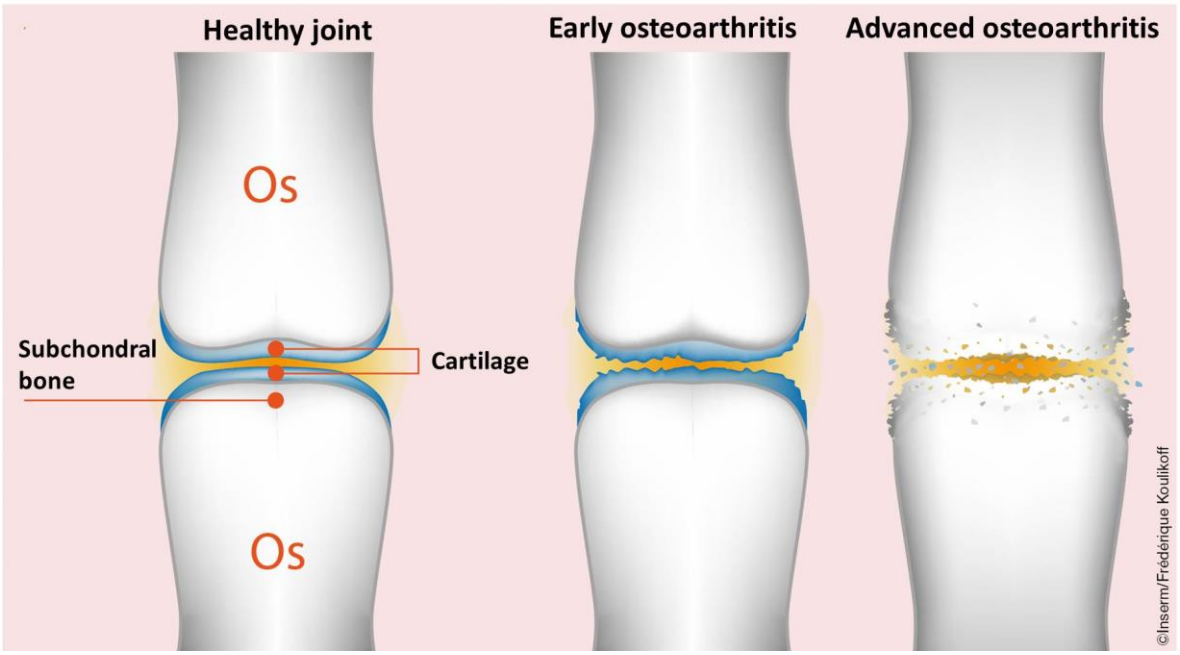
Press release

Innovative implants for repairing cartilage

In response to the increasing number of people with osteoarthritis, strategies are emerging for reconstructing cartilage. A team from Inserm (Unit 1109, "Osteoarticular and Dental Regenerative Nanomedicine," Inserm/University of Strasbourg), under the direction of Nadia Benkirane-Jessel, has developed a new generation of bone and joint implants. Their study, published in *Trends in Biotechnology*, shows that by combining stem cells and bone growth factors, these smart implants make it possible to regenerate a damaged joint.

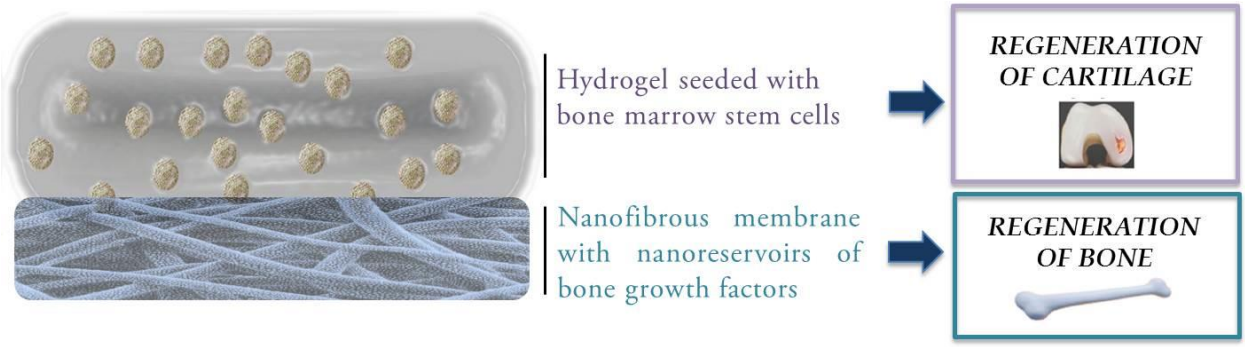
Our joints, those areas where two bones connect, accompany our movements and efforts. Joint mobility is provided by cartilage, which covers the ends of the bones (subchondral bone), and allows two bones to slide against one another. Being fragile, cartilage becomes worn with age, and gradually disappears. Osteoarthritis is the term used where destruction of the cartilage extends to the other joint structures, especially the subchondral bone.



At present, apart from fitting a prosthesis, one of the techniques used to repair cartilage involves injecting a sample of the patient's own cartilage cells (chondrocytes) into the joint. However, since the repair involves a damaged bone, the results are not always satisfactory.
Nadia Benkirane-Jessel and her team, which specialises in regenerative nanomedicine, had an idea for a new generation of implants, comprising two compartments:

- the first compartment is **a nanofibrous membrane** (based on collagen and polycaprolactone), designed to resemble the extracellular matrix surrounding the cartilage. Nanoreservoirs covering the fibres of this membrane contain bone growth factors.

- the second compartment is a **hydrogel layer** (of alginate and hyaluronic acid) containing **stem cells derived from the patient's bone marrow**. These cells can differentiate into either bone cells (osteoblasts) or cartilage cells (chondrocytes).



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This three-dimensional arrangement mimics the physiological environment of the joint, and provides enough porosity to allow infiltration of the stem cells. When these cells grow and divide, they infiltrate more deeply into the porous membrane and trigger the release of growth factors, which in turn stimulate cell proliferation.
Compared with other treatments, this technology offers dual therapeutic action: in addition to repairing the cartilage, it regenerates the subchondral bone located immediately underneath.

The researchers validated this technique in different animal models, and are awaiting funding to begin phase I clinical trials in humans. *"These trials will be conducted on 30 patients (aged 18–50 years) with knee lesions, recruited in three countries (France, England and Spain). The implant, already patented, will be placed using a single surgical procedure. The membrane containing the nanoreservoirs is first applied to the damaged joint, and the stem cells are then added,"* explains Nadia Benkirane-Jessel, Inserm Research Director.

If the trials are conclusive, this innovative technology will allow robust, long-term repair of arthritic or injured joints.

Source

Smart Implants as a Novel Strategy to Regenerate Well-Founded Cartilage
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