

## Master's internship – 2026

### AI-based Modeling for Osteochondral Regeneration Assessment

#### Supervision:

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#### Context:

Osteochondral damage in the knee is a condition primarily caused by aging but can also result from joint injuries, particularly in younger, active individuals. It often leads to pain and reduced mobility. Since cartilage lacks the ability to heal itself, untreated damage may progress to chronic osteoarthritis, a degenerative disease for which no cure currently exists. The Regenerative Nanomedicine INSERM lab has developed a novel biodegradable medical device in the form of a biomimetic implant aiming to support the regeneration of both cartilage and bone. The product is currently under clinical trials, for which there is a growing need of algorithms to 1) analyze the results and assess the efficiency of the treatment, and 2) simulate and predict the outcome of a surgically implanted device.

#### Work description:

This project serves as a preparatory study aimed at initiating the development of image analysis and prediction algorithms. The work will focus on exploring and benchmarking AI-driven techniques for image segmentation, registration, and longitudinal analysis pipelines to identify relevant morphological and textural biomarkers. The intern will work with several databases of MR images: small local databases of already implanted patients, and larger open databases such as RESTORE, Stanford SKM-TEA, or NIH Osteoarthritis Initiative.

After a careful study of literature, recent DL approaches such as for instance [1,2] will be considered, as well as the use of the more recent Neural Cellular Automata (NCA). This work will support the design of future predictive models applicable to the new implant's clinical data, which could be the focus of a subsequent PhD thesis.

#### References:

1. D.L. Ferreira, B.A.A. Nunes, X. Zhang, L. Carretero Gomez, M. Fung, R. Soni, *SAMRI-2: A Memory-based Model for Cartilage and Meniscus Segmentation in 3D MRIs of the Knee Joint*, Arxiv, <https://doi.org/10.48550/arXiv.2502.10559>
2. Zhipeng Ding, Marc Niethammer, *Aladdin: Joint Atlas Building and Diffeomorphic Registration Learning with Pairwise Alignment*, in CVPR 2022, New Orleans, LA, USA, 2022, pp. 20752-20761, doi: <https://doi.org/10.1109/CVPR52688.2022.02012>

#### Team and environment:

The internship will be part of a collaboration between multiple disciplines, and co-supervised by experienced researchers and clinicians.

The intern will be hosted in an office at the **iCube** Institute, Illkirch Campus of Strasbourg, and have access to all the necessary hardware and IT resources. The intern will occasionally go visit the INSERM team.

**Internship duration:** 5-6 months, starting January, February or March 2026.

**Profile:** MSc with a major in computer science or equivalent. Strong programming skills in python, strong knowledge in machine or deep learning, proficiency in English (oral and written).

*For further information and application, please contact the supervisors.*