1.5-year Post-Doctoral Fellowship in Biomechanics at Université de Montpellier

TITLE: Multiscale Characterization of Mechanobiological Responses in Cartilage under Biomimetic Robotic Stimulation

DURATION: 18 months (potential extension)

LOCATION: Université de Montpellier – LMGC, in collaboration with LIRMM, IRMB, and the industrial partner Symétrie

START DATE: Fall 2025

POSITION OVERVIEW:
The funded project aims to investigate the mechanobiological response of murine articular cartilage and intervertebral discs by replicating physiological loading conditions using a novel robotic platform compatible with advanced microscopy techniques. At the core of this platform is the SOLANO miniaturized hexapod robot, developed by the industrial partner Symetrie, which enables submicron-resolution, multi-axial motion finely controlled in terms of displacement, force, and velocity.

The postdoctoral researcher will be responsible for the robotic development and integration required to adapt this system for high-precision, dynamic biomechanical testing. This includes improving the actuation control (speed and smoothness of motion), ensuring synchronization with imaging systems (e.g., micro-CT, OCT, multiphoton microscopy, SEM), and developing customized loading protocols that mimic physiological conditions.

This interdisciplinary project bridges biomechanics, robotics, imaging, and biology, with the goal of uncovering micro- and nanoscale deformation mechanisms of cells within their native tissue environments, under both healthy and pathological conditions (e.g., osteoarthritis, inflammation). Experimental data obtained from ex vivo robotic tests will inform multiscale numerical models of tissue mechanotransduction, calibrated using in vivo murine gait analysis and behavioral tracking provided by IRMB.

AN INTERDISCIPLINARY ENVIRONMENT:

LMGC – The Laboratoire de Mécanique et Génie Civil is a joint research unit of the University of Montpellier and CNRS at the St. Priest research site in Montpellier, with approximately 120 members, including researchers, engineers, and PhD students. The lab specializes in the mechanical modeling of materials and structures. Within 7 different research teams, the BIOTIC team (Biomechanics of Interactions and Organization of Tissues and Cells) focuses on biomechanics, particularly the mechanical behavior of soft tissues and cellular behavior, tissue imaging (multiphoton, SEM, micro-CT), and mechano-biological modeling. The BIOTIC team collaborates closely with multiple other labs and the Montpellier University Hospital. https://lmgc.umontpellier.fr/

LIRMM – The Laboratoire d'Informatique, de Robotique et de Microélectronique de Montpellier is a joint research unit of the University of Montpellier and the CNRS, based at the St. Priest research site in Montpellier. With over 400 members—including researchers, engineers, and PhD students—it is a leading center for research in information, communication, and system sciences and technologies. Research is structured across three scientific departments, each organized into specialized teams. The DEXTER team, part of the robotics department, focuses on surgical robotics and parallel kinematics. Its goal is to design, develop, and control high-performance robots capable of fast, fine and precise movements. https://www.lirmm.fr/

IRMB/Cartigen – OsteoStart - The Institute for Regenerative Medicine and Biotherapy (IRMB) brings together the University Hospital Center of Montpellier, INSERM, and the University of Montpellier. It unites scientists and

clinicians to advance regenerative medicine and innovative immunotherapies, aiming to translate stem cell research into clinical applications, in coordination with specialists in chronic diseases (e.g. rheumatoid arthritis, lung and liver diseases, neurodegeneration, ageing, rare genetic and autoinflammatory disorders, diabetes, musculoskeletal diseases). **CARTIGEN** is a research and innovation platform of the University Hospital Center of Montpellier and the University of Montpellier. CARTIGEN specializes in motion modeling and 3D printing to better understand osteoarticular diseases and to develop tissue engineering approaches in regenerative medicine (https://www.chu-montpellier.fr/fr/cartigen). The **OsteoStart** Platform of IRMB is specialized in in-vivo movement analysis of murine models reproducing the major motor, osteo-articular and joint disorders. The goal of the platform is to develop and propose cutting-edges and non-invasive technologies in order to explore somatosensory, osteo-articular and locomotor functions in order to test cell and gene therapy protocols in pre-clinical trials (https://irmb-montpellier.fr/single-service/osteostart-platform/).

REQUIRED QUALIFICATIONS:

- Recent (up to 2 years) PhD in Biomechanics, Mechanical Engineering, Robotics, Bioengineering or related field

- Strong background in experimental **biomechanics** and/or **robotics**
- Experience with **microscopy**, image analysis is a plus
- Strong **programming** skills
- Strong **communication** skills and ability to work in an interdisciplinary environment
- Interest in **translational research** at the interface of mechanics, biology, and medical devices

FUNDING

The project is initially fully funded by the University of Montpellier and the ANR for a period of 18 months, with the possibility of extension. The starting gross monthly salary will be approximately €2300.

APPLICATION PROCEDURE:

- Candidates are invited to submit the following documents:

    - A detailed CV with a list of publications, and a copy of your diplomas
    - Cover letter highlighting relevant experience and motivation for the research project
    - Contact information for at least two academic references

- Applications should be sent to Dr Cristina Cavinato cristina.cavinato@umontpellier.fr and Dr Sebastian Krut sebastien.krut@lirmm.fr

- Deadline for application: **30 September 2025**

RELEVANT REFERENCES

Cavinato et al, 2021. Mech. Ageing Dev. 196, 111471.
Kirnaz et al, 2021. Int. J. Spine Surg. 15, 10–25 ;
Kloefkorn et al, 2015. Arthritis Res Ther. 17, 287 ;
Mausset-Bonnefont el al, 2025. Arthritis Res. Ther. 27, 42 ;
Orozco el al, 2022. PLOS Comput. Biol. 18, e1009398 ;
Petitjean el al. 2021. Mater. Sci. Eng. C 121, 111800 ;