A **PhD** position is available at the Biomaterials Department in the Centre for Biomedical and Healthcare Engineering at Mines - Saint Etienne, France

Topic: Mechanical stress in biological systems is pivotal in directing cells fate, tissue development, homeostasis and disease progression. Cells sense the mechanical force through their environment, the extracellular matrix (ECM), which is essentially a hydrated polymeric scaffolding.
Monitoring the influence of mechanical stress or strain onto cells embedded within a tissue-like ECM is essential for better understanding of homeostasis and disease progression in tissues like in the vascular system.
This is usually addressed by assessing forces exerted by cells on a mechanically tailored environment using classical imaging techniques and stretching, or using traction force microscopy. However, it is rarely done on a dynamic system and information on local stress and strain sensed by the cells is not gathered by these techniques, only the macroscopic deformation is controlled.
Therefore, there is a need to develop biomimetic mechanoresponsive ECMs emitting a signal-allowing mapping of the local forces applied to embedded cells.
The main aim of this thesis is to design, synthesize and characterize cytocompatible mechanochromic and mechanoluminescent hydrogels for strain/stress imaging in biological systems.
Change in absorption, fluorescent, and chemiluminescence can be generated upon stress application using chromophores, fluorophores and chemiluminophores integrated in a polymeric matrix. Careful design of the matrices will be required addressing the sensitivity to the stress applied the spatial and temporal resolutions of the evaluated changes in optical signal, and the reversibility of the phenomenon. Methods will be developed to assess the mechanochromic and mechanoluminescent properties of the hydrogels produced leading to mapping of the spatial and temporal response of the hydrogel under mechanical force. Finally, embedding of relevant cells such as smooth muscle cells will be performed in a relevant hydrogel formulation and their viability assessed. The influence of the cells on the hydrogel mechanoresponsive properties assessed.

Requirements: the ideal candidate holds or is next to a University degree in Biomedical Engineering, Materials Science, Chemistry or similar disciplines. Basic chemical laboratory skills are a must, whereas previous experience with scientific literature search, manufacturing technologies, mechanical testing, imaging techniques is a plus. The candidate must be very self-motivated and have a strong interest in biomaterials research.
We require good English language skills, computer literacy and a work ethic suitable to the challenges we plan to offer.

What we offer: Training at the forefront of biomaterials and bioengineering research; a challenging and rewarding research and educational program; a wide international network with the best scientists in the field.

About the workplace
The **CIS** – Centre for Biomedical and Healthcare Engineering is committed to design advanced biomaterials and develop manufacturing technologies for improved musculoskeletal disorders therapies. We create organic and inorganic biomaterials that react to environmental stimuli, that interact with cells and tissues and that are amenable to cutting-edge fabrication technologies.
By enhancing our knowledge of the biomaterials design and processing, and their interactions with cells, tissues and organs, we aim to develop the next generation of biomaterials.

The preferred **starting date** is September 2022 For more information please do not hesitate to contact Prof David Eglin david.eglin@emse.fr. The application consisting of motivation letter and CV can be sent to the same email address.