MuSkLE
PhD programme
Building, maintaining and repairing the functional locomotor system

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PhD Position 09 job vacancy

Reference:	**PP09**
Title:	**From Pattern to Fiber: Conductive Micropatterned Hydrogels for iPSC-Derived Cardiomyocyte and Myoblast Models**
Hiring institution:	**Lyon1**
Location:	University Claude Bernard Lyon 1, Villeurbanne, France.
Start date:	As from 1st September 2027
Duration:	36 months
Application deadline:	15th January 2027

Job description

Objective:

The recruited doctoral fellow **(DF09)** will develop conductive, micropatterned hydrogel platforms to create advanced *in vitro* models of human iPSC-derived cardiomyocytes (hiPSC-CMs) and iPSC-derived myotubes (hiPSC-Mts), enabling the assembly of aligned, polarized and multilayered muscle tissues. This project builds upon the DGL/PEG hydrogel platform from LBTI, the hiPSC-derived muscle cells expertise from INMG-PGNM and incorporates micropatterning techniques from UTT to overcome limitations of conventional 2D culture systems.

State of the Art: Human iPSC-derived cells are powerful tools for modelling diseases and drug screening, but current culture systems have major limitations among which cell multi-layered organization and polarization and live sub-cellular imaging. The LBTI has established a versatile DGL/PEG hydrogel that supports hiPSC-derived cells attachment, growth, and spontaneous contraction in porous matrices (collaboration with INMG-PGNM). The UTT partner has demonstrated that 2.5D micropatterns could be applied on hydrogel surfaces (5-30 µm features), allowing cell guidance. However, existing patterned systems lack electrical conductivity, surface ligand functionalization for early-differentiated hiPSC selection, and multilayer assembly for both cardiac and skeletal muscle modelling.

Hypothesis and Originality: We hypothesize that conductive, micropatterned hydrogels surface-functionalized with specific ligands will enable the creation of physiologically relevant hiPSC-derived models that combine: (i) cell-type specific attachment through ligand-mediated screening to enrich myotubes, (ii) architectural organization of hiPSC-CMs and hiPSC-Mts (aligned assembly and cell polarization) through surface topography, (iii) electrical functionality through enhanced conductivity, and (iv) optical compatibility for quantifiable alignment of multilayered myoblast fusion and live sub-cellular imaging. The originality lies in developing a first-of-its-kind platform that integrates mechanical tunability, geometric cues, electrical properties and bioactive surface chemistry to address critical gaps in both cardiac and skeletal muscle tissue engineering.

Methodology and Work Plan: The project is structured around four main objectives:
1- Hydrogel Development & Conductivity Optimization: Formulate DGL/PEG hydrogels with mechanical properties matching cardiac and skeletal muscle tissue. Incorporate conductive elements to achieve conductivity while maintaining optical transparency. Characterize using rheology, potentiostat, and confocal microscopy.
2- Micropatterning & Ligand Functionalization (with UTT partner): Use established techniques to create complex 2.5D patterns on hydrogel surfaces. Surface-functionalize with specific ligands to screen and promote cell adhesion and guide organization.
3- Dual-Cell Model Development and Validation (with INMG-PGNM partner): Culture hiPSC-CMs and hiPSC-Mts on patterned conductive hydrogels. For cardiomyocytes: assess polarization, Cx43 localization, intercalated discs, calcium transients. For myotubes: induce

	differentiation, promote multilayer assembly into muscle fibres, evaluate sarcomere organization and contractility. 4- Image Analysis & Functional Validation: Develop quantitative image analysis pipelines to evaluate: (i) cell alignment (orientation angle, alignment index), (ii) averaging of multiple myotubes layers (thickness, layer counting), (iii) Cx43 transport to cell-cell junctions via RUSH assay, (iv) electrical coupling via calcium imaging and MEA recordings. Validate for disease modelling (ACM for cardiac, muscular dystrophies for skeletal).
Collaborations and co-supervisions:	The PhD project will be implemented in collaboration with INMG-PGNM lab (Lyon) and L2n (UTT Troyes).
Supervisors:	Direction : Jérôme Sohier - jerome.sohier@cnrs.fr & co-supervision : Gaelle Boncompain - gaelle.boncompain@cnrs.fr
Place of work:	LBTI - CNRS UMR 5305 & INMG-PGNM - UMR 5261, Lyon, France
Required degree	Master's degree or equivalent in Biomaterials, Tissue Engineering, Biomedical Engineering, or Cell Biology
Skills/Experience:	Essential: Hydrogel formulation/characterization, surface chemistry and covalent grafting, microscopy (confocal/live-cell) and quantitative image analysis (ImageJ/Fiji, Python, or MATLAB), statistical analysis skills, cell culture (hiPSC advantageous). Advantageous: AI/ML basics, micropatterning techniques, electrical conductivity testing.
Keywords	Hydrogels, hiPSC, micropatterning, muscle models, electrical conductivity

Mandatory requirements

Eligibility:	The doctoral fellow: - should not have resided or carried out his/her main activity (work, study) in the country where he/she is being recruited, i.e., France, **for more than 12 months in the 3 years before the application call deadline,** unless this time was part of a compulsory national service or a procedure for obtaining refugee status under the Geneva Convention. - **must be in possession of a master's degree** at the date of the call deadline. Applicants who have completed their cursus but not yet been awarded the formal master's degree by that date will not be considered eligible. - must be **a doctoral candidate** (not already in possession of a doctoral degree at the date of the application call deadline).
Languages:	Oral and written skills must meet the standards of academic English used in international research.

Job details

Type of contract:	Full time position
Gross salary:	The monthly **living allowance, including employer and employees' social charges, is €3,500.** This amount corresponds to a gross monthly salary estimated to €2,440 and to an estimated net monthly salary before income tax of approximately €1,976. On top of the monthly salary, the doctoral fellow will receive a **mobility allowance,** including employer and employees' social charges of €4,752 over the 36 months of the working contract. This amount corresponds to a gross monthly allowance estimated to €92 and to an estimated net monthly allowance before income tax of approximately €74.
Other benefits:	**Social Protection**: The fellow will benefit from **full social security coverage**, including health insurance, unemployment insurance, and pension contributions. He/she will also have access to occupational health services (*médecine du travail*), as required by French labour law. **Additional Insurance**: The fellow may choose to subscribe to complementary health insurance plans, at affordable rates (approximately €70 *per* month), of which 50% is paid by the employer. **Paid Leave**: The fellow is entitled to up to **33.5 days of paid leave annually** (for 35 hours worked per week), in accordance with national labour law, and will enjoy the same employment rights as other public-sector employees. **Transport**: The fellow benefits from significantly **reduced fares on public transport**, available in all partner cities. Additionally, the host institution will cover 50% of the monthly transportation costs. **Sports and culture:** The fellow will enjoy the cultural environment provided by the Lyon 1 campuses, where numerous exhibitions and activities open to the general public are organised throughout the year. The fellow may play his/her favourite sport in the largest University Sports Association in France, where over 30 activities are on offer year-round through the Sports & Physical Activity University Department. The fellow may also join one of the 70 student associations that unite the University.