

Thomas LAVIGNE, PhD

Post-Doctoral Researcher | Biomechanics & Poromechanics

22 Esplanade Jacques Chirac, Suresnes, 92150, France | +0750289348 | lavignethomas@hotmail.fr
[Website: thomaslavigne.github.io](https://github.com/thomaslavigne) | [ORCID: 0000-0003-2690-3542](https://orcid.org/0000-0003-2690-3542)

PROFESSIONAL SUMMARY

Computational biomechanics researcher specializing in the poromechanical and multiscale modeling of soft biological tissues. Recently awarded a Dual Doctoral Degree (cotutelle Université du Luxembourg / ENSAM Paris) focused on developing a physics-based, hierarchical porous media framework to understand human skin micro-circulation and pressure ulcer aetiology. Recognized for bridging complex theoretical developments, *in vivo* experimental campaigns, and high-performance numerical implementation. Dedicated to Open Science and reproducibility, having developed open-source simulation tutorials (FEniCSx). Described by the PhD defense jury as an exceptional scientist positioned to become a "reference in this emerging field."

EDUCATION & ACADEMIC HONORS

Co-tutelle PhD in Engineering Sciences (Biomechanics) | Sept 2022 – July 2025

AFR-FNR Grant 17013812 | Univ. Luxembourg, ENSAM (Paris), & I2M (Bordeaux)

- **Thesis:** *Biomechanical Response of Human Skin: A Hierarchical Porous Media Framework.*
- **Directors:** Pr. Stéphane Bordas (Uni.lu), Dr. Pierre-Yves Rohan (ENSAM), Dr. Giuseppe Sciumè (I2M).
- **Honors & Awards:**
 - **2025 Excellent Thesis Award** (University of Luxembourg).
 - Nominated for the **Tarrach Prize** ("*Les Amis de l'Université du Luxembourg*").
 - Unanimously proposed for the **Prix Bézier** (ENSAM).
 - Applicant for the **FNR Outstanding PhD Thesis Award**.
 - **Best Poster Award** (Ranked 2nd, PhD Day, Luxembourg 2024).

Master of Science in Biomechanics (BME Paris Program) | 2020 – 2021

École Nationale Supérieure des Arts et Métiers (ENSAM), Paris

- **Rank:** 4/27

Master 1 & Bachelor's in Mechanical Engineering Sciences | 2018 – 2020

École Normale Supérieure (ENS) Paris-Saclay

- **Master 1 Rank:** 1/18. **Bachelor's:** Received with high honors (Rank: 12/70).

Classes Préparatoires aux Grandes Écoles (PCSI/PSI)* | 2016 – 2018

Lycée Hoche, Versailles, France

- Intensive two-year preparation for highly competitive national engineering entrance exams.

RESEARCH EXPERIENCE

Post-Doctoral Researcher (CNRS ANR Rosaly) | Dec 2025 – Nov 2027

Laboratoire de mécanique des solides (LMS), Ecole Polytechnique, CNRS

- Leading poromechanical modeling and characterization of collagen hydrogels.
- Group website in progress: [click here](#)

Post-Doctoral Researcher | Sept 2025 – Nov 2025

Université de Bordeaux (I2M)

- Extended multi-compartment poromechanical models for biological soft tissues. HPC installation of FEniCS (MCIA).

Doctoral Researcher | Sept 2022 – June 2025

Legato Team (Luxembourg) / IBHGC (France) / I2M (France)

- **Model Development:** Developed a novel bi-compartment poromechanical framework distinguishing interstitial fluid from blood flow to simulate mechanically induced ischemia and reactive hyperaemia without complex neurological control laws.
- **Experimental Campaign:** Designed and conducted a gender-inclusive *in vivo* experimental campaign on 11 human volunteers, combining controlled mechanical indentation with Laser Doppler Flowmetry (LDF).
- **Numerical Innovation:** Created a "Numerical Phantom" methodology using synthetic 3D porous microstructures and EDAC-DCPSE fluid dynamics to calculate effective permeability tensors *in silico*.

Research Intern | Sept 2021 – Sept 2022

Legato Team (Luxembourg) & LMPS (France) | Supervisors: S. Bordas

- **Project:** *Surrogate Modelling of Breast Tissue Deformation.*
- Adapted Digital Volume Correlation (DVC) techniques to capture breast deformation from medical CT-scans.
- Executed end-to-end methodologies: image processing, patient-specific meshing, inverse/forward hyper-elastic FEM.

Research Intern | Sept 2020 – Aug 2021

IBHGC (France) | Supervisor: P.-Y. Rohan

- **Project:** *Experimental investigation of skeletal muscle tissue response to compressive loads using consolidation theory.*
- Work contributed directly to the supervisor winning the 2021 Société de Biomécanique Young Investigator Award.

Research Intern | April 2020 – July 2020

IBHGC (France) | Supervisor: S. Laporte

- **Project:** *Development & Modelling of impact on professional rugby players.*

Mechanical Engineering Project | Sept 2019 – mid 2020

LMT Laboratory (France) | Supervisor: F. Hild

- **Project:** *Tomographic tracking of a torsion test on a metamaterial structure.*
- Resulted in the 2024 "Most Cited Paper Prize" from the Journal of Strain Analysis.

OPEN SCIENCE & COMMUNITY ENGAGEMENT

- **Lead Developer, FEniCSx & GMSH Tutorials:** Created and currently maintain a comprehensive, open-source repository teaching the implementation of large-deformation poroelastic models. This resource organically initiated international collaborations (e.g., Univ. Leeds, IMT Atlantique).
- **Co-Organizer, FEniCSx-Gmsh Training-Symposium:** Co-led a training symposium with G. Sciumè at I2M Bordeaux (Sept 2024) to democratize advanced computational biomechanics tools.
- **Organizing Committee Helper:** CMBBE 2023 Congress hosted at ENSAM Paris.
- **Scientific Communication:** Currently developing the website of the joined LMS subgroup. Managed the Legato Team laboratory website and YouTube channel. Conducted science outreach for high school students via Eduscol.

- **Author:** Co-authored the new edition of the physics exercise book *Oraux corrigés et commentés de Physique-Chimie PSI/PSI** for French oral examinations.

TEACHING & MENTORING

Student co-supervision | 2025 – 2026

LMS, Ecole Polytechnique

- Co-supervise internships (L3: G. Deremble, M1: P. Namazian) in Mechanics, and Computational Methods applied to the cornea and hydrogel modelling.

Lecturer & Teaching Assistant | 2022 – 2025

ENSAM Paris

- Delivered courses (L3, M1, M2 levels) in Mathematics, Dynamics, Informatics, Mechanics, and Experimental Methods.

Academic Tutor | 2020

École Normale Supérieure Paris-Saclay

- Provided tutored sessions for students requiring additional academic support.

Oral Examiner (Colleur) | 2018 – 2020

Lycée Hoche, Versailles

- Conducted weekly oral examinations in Physics, Chemistry, and Engineering Sciences for students preparing for national competitive exams. Mentored small groups on university orientations and research career paths.

PUBLICATIONS

Peer-Reviewed Journal Articles

- **Lavigne, T.**, et al. (2025). *Hierarchical poromechanical approach to investigate the impact of mechanical loading on human skin micro-circulation*. Int. J. Numer. Method. Biomed. Eng. [DOI: 10.48550/arXiv.2502.17354]
- **Lavigne, T.**, et al. (2025). *Poromechanical modelling of the time-dependent response of in vivo human skin during extension*. Int. J. Numer. Method. Biomed. Eng. [DOI: 10.48550/arXiv.2412.07374]
- **Lavigne, T.**, et al. (2023). *Single and bi-compartment poro-elastic model of perfused biological soft tissues: FEniCSx implementation and tutorial*. Journal of the Mechanical Behavior of Biomedical Materials. [DOI: 10.1016/j.jmbbm.2023.105902]
- **Lavigne, T.**, et al. (2023). *Identification of material parameters and traction field for soft bodies in contact*. Computer Methods in Applied Mechanics and Engineering. [DOI: 10.1016/j.cma.2023.115889]
- **Lavigne, T.**, et al. (2022). *Digital Volume Correlation for Large Deformations of Soft Tissues: Pipeline and Proof of Concept for the application to Breast ex vivo Deformations*. [DOI: 10.1016/j.jmbbm.2022.105490]
- **Lavigne, T.**, et al. (2022). *Numerical investigation of the time-dependent stress–strain mechanical behaviour of skeletal muscle tissue in the context of pressure ulcer prevention*. Clinical Biomechanics. [DOI: 10.1016/j.clinbiomech.2022.105592] (*Société de Biomécanique Young Investigator Award 2021*)
- Auger, P., **Lavigne, T.**, et al. (2020). *Poynting effects in pantographic metamaterial captured via multiscale DVC*. Journal of Strain Analysis. [DOI: 10.1177/0309324720976625] (*Most Cited Paper Prize 2024*)

Co-Authored Preprints & Contributions

- **Lavigne, T.**, et al. (2025). *Synthetic Porous Microstructures: Automatic Design, Simulation, and Permeability Analysis*, arXiv preprint arXiv:2502.14518
- Kerachni, A., et al. (2024). *MRI-based computational modeling of human cortical folding*. Scipedia.
- *Additional international co-authored studies spanning brain modeling, tumor DVC modeling, and microfluidics.* ([Website: thomaslavigne.github.io](https://thomaslavigne.github.io))

CONFERENCES & PRESENTATIONS

- **Euromech 670** (France) – Oral Communication (April 2025)
- **EPUAP 2024** (Switzerland) – Oral Communication (Sept 2024)
- **Interpore BeneLux 2024** – Poster Presentation (April 2024)
- **Journées thématiques de la F2M** – Oral Communications (Feb 2023, April 2024)
- **BSSM's 17th International Conference on Advances in Experimental Mechanics** – Oral Communication
- **18th Int. Symposium on Computer Methods in Biomechanics and Biomedical Engineering (CMBBE)** – Poster
- **46th Congress of the Biomechanical Society** – Oral Communication [DOI: 10.1080/10255842.2021.1978758]

PATENTS & INTELLECTUAL PROPERTY

- **Co-Inventor:** Neurosurgical Navigation System Using Physics-Informed Intraoperative Brain Deformation Tracking
 - **Application Number:** LU509777 (Luxembourg)
 - **Status:** Patent pending

TECHNICAL SKILLS & LANGUAGES

- **Programming & Software:** Python, FEniCSx, Matlab, C++ (Basic), Cast3M, Abaqus, Mathematica (AceFEM/AceGEN), Catia, Solidworks, Slicer3D, Git, HPC environments.
- **Specialized Methods:** Digital Volume Correlation (DVC), Finite Element Method (FEM), Medical Image Processing.
- **Languages:** French (Native), English (CAE: C1 Advanced), Spanish (Basic).

PERSONAL INTERESTS

- **Sports:** Cycling, Scuba-diving (3rd Level National License), Skiing.
- **Hobbies:** Guitar, Photography.