Thomas LAVIGNE, PhD

Post-Doctoral Researcher | Biomechanics & Poromechanics

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PROFESSIONAL SUMMARY

Computational biomechanics researcher specializing in the poromechanical and multiscale modeling of soft biological tissues. Recognized for bridging complex theoretical developments, in vivo experimental campaigns, and high-performance numerical implementation. Dedicated to Open Science via open-source simulation tutorials (FEniCSx) and praised by the PhD defense jury as an exceptional scientist positioned to become a « reference in the field ».

EDUCATION & ACADEMIC HONORS

Co-tutelle PhD in Engineering Sciences (Biomechanics) | Sept 2022 – July 2025
Univ. Luxembourg, ENSAM (Paris), & I2M (Bordeaux)

- **Thesis:** Biomechanical Response of Human Skin: A Hierarchical Porous Media Framework.
- **Honors:** 2025 Excellent Thesis Award (Uni.lu), Nominated for Tarrach Prize, Unanimously proposed for Prix Bézier (ENSAM), Best Poster (Ranked 2nd, PhD Day 2024). Applicant for FNR Outstanding PhD Thesis.

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 | M1 Rank: 1/18 | BSc: High Honors (12/70)

RESEARCH EXPERIENCE

Post-Doctoral Researcher | LMS, Ecole Polytechnique, CNRS | Dec 2025 – Nov 2027

- Poromechanical modeling and characterization of collagen hydrogels (ANR Rosaly).

Post-Doctoral Researcher | Université de Bordeaux (I2M) | Sept 2025 – Nov 2025

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

Doctoral Researcher | Legato (Luxembourg) / IBHGC & I2M (France) | Sept 2022 – June 2025

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

Early Research Internships | Legato, LMPS (LMT), IBHGC| April 2020 – Sept 2022

- *Breast Tissue DVC (2021-22):* Adapted Digital Volume Correlation (DVC) techniques to capture deformation from CT scans; executed patient-specific meshing and inverse/forward hyper-elastic FEM.
- *Skeletal Muscle (2020-21):* Modeled compressive loads using consolidation theory, directly contributing to the supervisor's 2021 Société de Biomécanique Young Investigator Award.
- *Metamaterials (2019-20):* Tomographic tracking of torsion tests (Resulted in the 2024 "Most Cited Paper Prize" from the *Journal of Strain Analysis*).

OPEN SCIENCE & COMMUNITY ENGAGEMENT

- **Lead Developer:** Create and maintain an open-source repository teaching the FEniCSx/GMSH implementation of large-deformation poroelastic models, initiating global collaborations.
- **Event Organizer:** Co-led a FEniCSx-Gmsh Training-Symposium at I2M (Sept 2024); Organizing Committee Helper for CMBBE 2023 at ENSAM.
- **Scientific Communication:** Manage websites for the LMS subgroup and Legato Team; conduct high school science outreach via Eduscol.
- **Author:** Co-authored the physics exercise book *Oraux corrigés et commentés de Physique-Chimie PSI/PSI**.

TEACHING & MENTORING

- **Student Co-supervision (2025–2026):** Mentoring L3, M1, and M2 interns at LMS (Ecole Polytechnique) in mechanics and computational methods applied to cornea and hydrogel modeling.
- **Lecturer & TA (2022–2025):** Delivered ENSAM Paris courses (L3-M2) in Math, Dynamics, Informatics, and Mechanics.
- **Oral Examiner & Tutor (2018–2020):** Conducted weekly CPGE exams (Lycée Hoche) and academic tutoring (ENS Paris-Saclay).

SELECTED PUBLICATIONS

(Full list of peer-reviewed articles and preprints available on ORCID and personal website)

- **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.*
- **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.*
- **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.*
- **Lavigne, T.**, et al. (2023). Identification of material parameters and traction field for soft bodies in contact. *Computer Methods in Applied Mechanics and Engineering.*

SELECTED CONFERENCES & PRESENTATIONS

- **Oral Communications:** Euromech 670 (2025), EPUAP (2024), Journées thématiques F2M (2023, 2024), BSSM's 17th Int. Conference, 46th Congress of the Biomechanical Society.
- **Poster Presentations:** Interpore BeneLux (2024), 18th Int. Symposium CMBBE.

PATENTS

- **Co-Inventor:** Neurosurgical Navigation System Using Physics-Informed Intraoperative Brain Deformation Tracking. *Patent Pending: LU509777 (Luxembourg)*.

TECHNICAL SKILLS

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

PERSONAL INTERESTS

Cycling, Scuba-diving (Level 3 National License), Skiing, Guitar, Photography.