

JOSEPH BRUNET

71 Av. des Martyrs, 38000 Grenoble, France, jo.brunet73@gmail.com

EDUCATION

- École des Mines de Saint-Étienne, France** *Nov 2017 - Mar 2021*
Ph.D. in Biomechanics
- Paris Descartes University, France** *Sep 2016 - Oct 2017*
Master of Science - MS, Biomedical Engineering - Major in Biomechanics
- École Nationale Supérieure d'Arts et Métiers, France** *Sep 2014 - Oct 2017*
Master's Degree in Mechanical Engineering

RESEARCH EXPERIENCE

Postdoctoral Research Associate | University College London (UCL), *Sep 2021 - Present*
Funded by the Chan Zuckerberg Initiative

Research Fellow in ultra-high resolution quasi-dynamic X-ray imaging of human organs and joints using synchrotron tomography

- Preparation of biological human and animal samples for quasi-dynamic biological scanning
- Perform Hierarchical Phase-Contrast Tomography (HiP-CT) scans at the European Synchrotron Radiation Facility (ESRF)
- Development of a quasi-dynamic experimental setup to perform in situ testing on coronary stent expansion in a complete heart
- Development and application of imaging analysis techniques, in particular digital volume correlation, to interpret quasi-dynamic biological system behaviour

PhD Researcher | École des Mines de Saint-Étienne, France *Nov 2017 - Sept 2021*
Funded by the European Research Council

Advisors: Pierre Badel, Éric Maire

Thesis: Understanding the mechanisms of aortic dissection: finite element modeling and *in situ* experimentation with X-ray tomography

- Collection and manipulation of arterial tissue from pigs and rabbits
- Tensile and peeling tests to assess the elastic and fracture properties of the tissue
- Development of a tension-inflation device fitting inside an X-ray tomography setup and its computer interface
- In situ 3D imaging of the dissection of pressurized arterial segments by X-ray microtomography and synchrotron-based phase-contrast imaging
- Modeling of the observed failure phenomena using the extended finite element method

Research intern | Medtronic, France *Jul 2017 - Nov 2017*

Experimental and numerical study on meshes for abdominal hernia repair

- Uniaxial, biaxial, and indentation tests on different type of textiles
- Modeling the observed mesh behaviors with a nonlinear, anisotropic, plastic model

M.S. Researcher | École des Mines de Saint-Étienne, France *Jan 2017 - Jul 2017*
Advisor: Pierre Badel

Thesis: Investigation of shear delamination during rupture of arterial medial tissue using cohesive numerical model

PUBLICATIONS

Brunet, J., Walsh, C. L., Wagner, W. L., Bellier, A., Werlein, C., Marussi, S., Jonigk, D. D., Verleden, E. S., Ackermann, M., Lee, D. P., Tafforeau, P. Preparation of large biological samples for high-resolution, hierarchical, multi-modal imaging. *Nature Protocols*, 2022. Accepted (on BioRxiv).

Brunet, J., Pierrat, B., Adrien, J., Maire, E., Lane, B. A., Curt, N., Bravin, A., Laroche, N., Badel, P. In situ visualization of aortic dissection propagation in notched rabbit aorta using synchrotron X-ray tomography. *Acta Biomaterialia*, 2022. In Press.

Brunet, J., Pierrat, B., Badel, P. A parametric study on factors influencing the onset and propagation of aortic dissection using the extended finite element method. *IEEE. Trans. Biomed. Eng.*, vol. 68, pp. 2918-2929, 2021.

Brunet, J., Pierrat, B., Adrien, J., Maire, E., Curt, N., Badel, P. A Novel Method for In Vitro 3D Imaging of Dissecting Pressurized Arterial Segments Using X-Ray Microtomography. *Exp. Mech. Sp Iss: Experimental Advances in Cardiovascular Biomechanics*, vol. 61, pp. 147157, 2020.

Brunet, J., Pierrat, B. and Badel, P. Review of current advances in the mechanical description and quantification of aortic dissection mechanisms. *IEEE Rev. Biomed. Eng.*, vol. 14, pp. 240-255, 2021.

Brunet, J., Pierrat, B., Adrien, J., Maire, E., Badel, P. A combined experimental-numerical lamellar-scale approach of tensile rupture in arterial medial tissue using X-ray tomography. *J. Mech. Behav. Biomed. Mater.*, vol. 95, pp. 116-123, 2019.

CONFERENCE PRESENTATIONS

In situ quantification of the mechanical behavior of coronary arteries during angioplasty using synchrotron X-ray tomography in intact porcine hearts. Oral presentation delivered at the **BioMedEng22**, at University College London, London, September, 2022

Imaging of whole human organs using Hierarchical Phase-Contrast Tomography (HiP-CT). Oral presentation delivered at the ImagingBioPro Network Workshop at BioMedEng22 (Leveraging Next-Gen Multiscale Imaging at Central Facilities for Biomedical Engineering Research) at the **BioMedEng22**, at University College London, London, September, 2022

High-resolution imaging of whole human heart using synchrotron x-ray tomography. Oral presentation delivered at the **ICTMS 2022**, Grenoble, July, 2022

3D characterization of crack propagation during the onset of a dissection using X-ray microtomography on pressurized aortic segments. Oral presentation delivered at the **26th Congress of the European Society of Biomechanics**, Online, July, 2021

Investigation of notch propagation in an in-vitro dissection model using X-ray microtomography. Oral presentation delivered at the **45th Congress of the Société de Biomécanique**, Online, October, 2020

A numerical design of experiment approach to understand aortic dissection onset and propagation. Oral presentation delivered at the **44th Congress of the Société de Biomécanique**, Poitiers, France, October, 2019

Chairman of the session "Macro-scale biofluids", **44th Congress of the Société de Biomécanique**, 2019 at University of Poitiers, France

A new approach combining experiment and numerical simulation using cohesive interface to model tensile failure in arterial medial tissue at the meso-scale. Poster presentation delivered at the **8th World Congress of Biomechanics**, Dublin, Ireland, July, 2018.

Characterization and modelling of rupture in arterial medial tissue under tension from in situ experiments with X-ray tomography. Oral presentation delivered at the **15th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering**, Lisbon, Portugal, March, 2018

AWARDS

Proof of Concept Awards (PoCAs) delivered by ImagingBioPro Network. Project: Uniaxial in situ testing combined with synchrotron and conventional X-ray tomography to characterise the mechanical behaviour of healthy and diseased myocardium.

TEACHING EXPERIENCE

- Co-Supervisor of master students, ESRF** *2021 - 2022*
Projects: Image processing and analysis
- Teaching Assistant, École des Mines de Saint-Étienne** *2018 - 2020*
Courses: Experimental mechanics, Finite element method
Supervisor of master students - Industrial and research projects
- Tutor for students in difficulty, Saint-Exupery middle school, Macon** *2015 - 2016*
Courses: Mathematics and physics

ACADEMIC SERVICE

- PhD student representative** *2018 - 2020*
Board of the Doctoral School of Science, Engineering and Health of the University of Lyon
- PhD student representative** *2018 - 2020*
Board of SAINBIOSE laboratory (INSERM)
- President of the Saint-Étienne Doctoral Students' Club** *2018 - 2019*

REFERENCES

Peter Lee, Prof
Dept of Mechanical Engineering
University College London, UK
Phone: +44 1235 567789
Email: peter.lee@ucl.ac.uk

Baptiste Pierrat, PhD
Department of Biomechanics
École des Mines de Saint-Etienne, France
Phone: +33 4 77 49 97 38
Email: baptiste.pierrat@mines-stetienne.fr