

# JOSEPH BRUNET

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## EDUCATION

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- 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

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**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

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**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

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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

## TEACHING EXPERIENCE

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**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

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**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

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